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Educating the Public

EDUCATION of the public to the importance of engineering work should be a part of any plan for engineering publicity—in fact is the ultimate end of all such publicity. Appreciation of a work will lead surely to appreciation of the worker. For that reason the plan of advertising to the public the merits of a new pavement, as explained on page 10 of this issue, is to be highly commended. The idea is not new, though its infrequent use shows conclusively that its value is not appreciated. Here and there engineers have marked test roads, and in New York signs on the contractors' structures along the line of a new subway tell of which route the particular section is a part, the name of the contractor and of the body, the Public Service Commission, in charge of the work. The education of the public in matters engineering, even if in so fragmentary a way, cannot but have favorable results. The scheme has endless possibilities limited only by the ingenuity of those in charge.

Municipal Bond Market

THAT municipalities with good credit have every reason for being encouraged at the present condition of the money market is apparent from the success of recent large bond sales. On Tuesday of this week New York City received bids for $71,000,000 in 4½ per cent issues, of which $46,000,000 was in fifty-year bonds to finance revenue-producing improvements and $25,000,000 in fifteen-year serial corporate stock, to pay for non-revenue producing improvements. The issue was over-subscribed three times, the bids totaling $320,000,000. The fifty-year bonds went at an average price of 101.253 and the fifteen-year bonds at 101.306. Contrasted with these prices is the average of 100.137 for the last sale of New York City's 4½'s in 1913. It is apparent, therefore, that money can readily be obtained for municipal improvements, though at an advanced rate, and that that phase of our activity is being less influenced by the war than is private enterprise.

Convention Returns

TO LEARN of the latest kinks and to get in touch with the "live wires" of the field are arguments with which many waterworks superintendents every year have to ply their superiors to permit them to attend the meetings of the large associations. Will it pay us to have you attend this convention, and in what way, is the usual opposing rejoinder. It was, therefore, with some degree of satisfaction that one superintendent was able to save his company much more than his convention expenses by listening to a discussion at the meeting of the American Waterworks Association on "Arsenic in Alum," a subject which many present felt should be taboo. A manufacturing company near a filter plant found that a shipment of alum contained more arsenic than was permissible in preparing medicinal glycerine. From calculations based on the figures given at the convention the superintendent found that one would have to drink 40 gal. of water, each gallon treated with 6 grains of alum, to get a medicinal dose of arsenic. This assumed that all of the arsenic would remain in the filtered water, which is not the case. Furthermore, arsenic is not a cumulative poison and little if any of the water from this plant is used for human consumption. Thus with the data fresh in mind the superintendent was able to seize the opportunity to get the discarded alum at a material reduction over the market price and still feel that the occasional careless workman who drank the water would not be injured. Far be it from this journal to promote the use of alum containing a high arsenic content, but, as noted at the time of the convention, the data are good stock in trade. The waterworks official wants to know more about every detail in the manufacture of his product than any one outside the department. He can get much information at waterworks conventions, but unfortunately the direct financial return from ideas picked up there is not always as easily traceable as in the instance cited above.

Testing Materials Convention

IT HAS been the pleasure of this journal from year to year to record the remarkable progress of the American Society for Testing Materials and to voice the appreciation by those in attendance of its efficient management and invaluable contributions to the engineering profession and the industries which serve it. Less in the public and professional eye than other engineering societies, because it holds but one meeting a year, it goes its way quietly, though meanwhile its committees, through their activities, are measuring off professional mile-stones, of which we become aware only when the yearly cycle exhibits the fruition of their work at the annual meeting. As has been pointed out previously in these columns the scope of the society is steadily widening and, perforce, its influence is being felt in ever broadening circles. During the last year, for example, new committees were formed on hollow building tile, on gypsum, on textile materials and on revision of pipe threads. Meanwhile the older committees have been expanding their work by the organization of new sub-committees and attacking hitherto unstudied problems in their fields. The committee on concrete and concrete aggregate, for example, though a comparatively new one, has laid out a most elaborate program (printed on page 14 of this issue). While that program is more than ordinarily ambitious it is, in its general spirit, characteristic of the thoroughness with which the society is studying the problems set before it. Needless to say the society by reason of its excellent work merits the heartiest support of engineers and manufacturers. Its work has been of great benefit to both, and with increased membership and strict adherence to the ideals which have made for it a unique place among American technical organizations, it faces a future of even greater usefulness.

Evidence of Influence

REFERENCE was made in the preceding note to the widening influence of the American Society for Testing Materials. Increasing use of the standard specifications was to be expected on the part of private interests whose engineers, chemists and manufacturing experts are members of the association. The executive committee pointed out in its report, however, that Federal, State and municipal authorities in increasing numbers were turning to the standards of the society, thus indicating that among engineers generally and those in charge of important enterprises the standing of the society is keenly appreciated. The report stated that the purchases for the Panama Canal have been largely made under the society's standards, twenty-seven of the specifications being used by the purchasing department of the canal. Furthermore, the material for the United States postal cars is purchased under those standards, while nine of the specifications have been adopted, in some cases with slight modification, in connection with the boiler code recently prepared by a committee of the American Society of Mechanical Engineers. Similarly in the current revision of the building code of the city of New York, seven standards of the society are used. It needs only more general knowledge of the work of the society to have the adoption of its specifications carried still further, and with the efforts which will be made during the coming year to increase the membership of the society, the increase in influence should be very gratifying indeed.

Responsibility of Power

IN SETTING forth in its annual report evidence of the widening influence of the society, the executive committee of the American Society for Testing Materials emphasized that the wider the confidence placed in the work of the society, the greater the reciprocal obligation upon the organization to justify that confidence in connection with everything to which its name is attached. Fortunately, the character of the work of the various committees shows clearly that this serious responsibility is keenly appreciated. But there was further evidence of appreciation of this responsibility. On motion of the executive committee, the annual meeting approved and passed on to letter ballot an amendment to the by-laws which, if accepted, will make the work of the society still more conservative and further safeguard against too hasty adoption of standards. Heretofore, it has not been unusual in one annual meeting and a letter ballot immediately following thereafter to place a new specification in the society's year book as a standard. That might still be done under the proposed amendment, though it is expressly stipulated that such action is to be taken only for exceptional reasons and then only if a nine-tenths vote of those voting at an annual meeting approve the course. Normally, under the newly proposed plan, specifications proposed for the first time and amendments of existing standards shall be published in the year book for one year as "tentative standards," on which written discussions addressed to the appropriate committee shall be invited. This plan would place still another step in the process of raising a proposed draft to the dignity of a standard. With the exception of those special cases above referred to, all proposals would therefore be held up for the invited criticism of the society for an entire year, giving ample time to discuss them, to experiment with their requirements if desirable, and to be certain that haste has not prevented the discovery of valid objections thereto. With this disposition evident in the society, combined with the progressive spirit of the committee work, no fear need be entertained that the society will fail to live up to the responsibility which its widening influence imposes upon it.

Street-Lighting Developments

INTERESTING developments in street lighting are coming on apace as the contest between the gas-filled incandescent lamp and the high efficiency arc grows more acute. Cities desiring to utilize the most modern equipment in renewing their street-lighting contracts will do well to investigate the designs now available in a thorough fashion before deciding upon any particular type of apparatus. There is a lot more to the problem than a good many municipal officials have realized.

Just now there is a close balance between the gas-filled lamp and the low-powered arc for the illumination of subordinate streets. It would not take much of a change in prices to shift the scales either way. As one goes into the larger units, the high efficiency arc lamp still seems to be more than holding its own. Really wonderful effects are being attained by the use of the prismatic refractor and improved electrodes, even when the units are spaced as far as 600 ft. apart and carried 25 ft. above the roadway. Half way between two such lamps of the 6.6-ampere size one can read the second hand of a watch. Few cities have as yet awakened to the increased effectiveness of illumination made commercially possible by these two factors alone, but the perennial demand of more light for less money is sure to find out these developments sooner or later. Central stations are not to be blamed for introducing one improvement at a time, considering the frequent short life of street-lighting contracts.

Before long we are likely to see changes in the direction of better fixtures for service based on gas-filled incandescents, coupled with some sort of discrimination between the lighting requirements of classified streets. Unless politics prevents, the time is not far distant when several different types of lighting units and different sizes of the same unit may be effectively employed in the same town. The practice of replacing old and inefficient lamps by new and better units in exactly the same locations will give way to improved engineering treatment of neighborhood requirements. If the lessons of Continental Europe mean anything, more attractive fixtures for outdoor service are surely coming. Before long, also, we shall be in possession of more complete life records of gas-filled lamps for series service. The uncertain factors are being narrowed down, and one may confidently expect general improvement in the lighting of streets in American cities during the next few years.

Operation of Imhoff Tanks

IMHOFF tanks for sewage treatment have been such a comparatively recent development in the United States that most of the information concerning them has related to design and construction rather than to operation. Among the pioneer plants in this country were the three at Atlanta, completed in 1912. Sufficient time has now elapsed to warrant an analysis of their operation and the article dealing with the Proctor Creek works, on page 4 of this issue, by Charles C. Hommon, chemist and bacteriologist in charge, is of particular value because it sets forth in detail for the first time the operating methods and results obtained at a large municipal plant of this type. The installation comprises, in addition to the two-story settling tanks, grit chambers and sprinkling filters.

In the early days at Atlanta some trouble was caused by "foaming" at the gas vents of the settling tanks. The increase in the height of the vents did not improve matters, and it was finally discovered that the foaming was caused by the sludge reaching too high a level in the digestion chambers. When the sludge from the filled compartment was withdrawn the foaming ceased. This discovery naturally set the interval for sludge discharge. It is interesting to note, also, that the tank effluent has been so clear that use of the revolving screen between the tanks and the filters was discontinued after the first few weeks of service. The screen was installed as an insurance against the clogging of the sprinkling-filter nozzles, but such good results were obtained without it that it was decided to save the expense of its operation.

The operating costs of the whole plant, exclusive of interest on investment and depreciation, have averaged $3.93 per million gallons. The first sludge was withdrawn five months after the tanks were placed in service and was of good quality. The aim in operating the tanks is to remove enough sludge during the summer and fall to carry each unit through the winter months without emptying. Mr. Hommon's figures show that the plant is effecting a satisfactory degree of nitrification and is doing well the work for which it was designed.

American Sanitary Engineers in Servia

ON MAY 15 a party of sanitary engineers and physicians left New York for Servia to serve under Dr. Strong of the American Red Cross Society in the Sanitary Commission. They arrived in Athens on June 5 and by this time are in the field. The party was in charge of Mr. Edward Stuart, a graduate of the Massachusetts Institute of Technology, who had had experience as a State sanitary engineer in Oklahoma and had been engaged in engineering work in Brazil. The assistant sanitary engineers were recruited from graduates of the Massachusetts Institute of Technology and the School of Engineering of Harvard University. The School for Health Officers furnished two physicians who had just been awarded the certificate in public health. Two of the men were assistant engineers in the Massachusetts State Department of Health. The party was, therefore, composed of young men who were unusually well qualified for their task.

Their work is to clean up Servia in order to prevent the spread of typhus fever and cholera, which dread diseases have already made terrible ravages among the inhabitants, many of whom have been driven from their homes and are living under most insanitary conditions. What problems will have to be met cannot be well forecast, but two of them are known. Clean water must be provided and war must be waged on the body louse, which is the agent by which typhus fever is transmitted. There are few large cities in Servia and the problem in general will be that of camp sanitation.

The undertaking will be a hazardous one for the young sanitarians. As preventive measures each one was vaccinated against typhoid fever before leaving this country, and the new vaccination treatment against typhus fever was taken by them during the voyage across the Atlantic.

In this way, thanks to the American Red Cross Society and the Rockefeller Foundation, American engineers are not only helping to save life in Servia but are acting as an outer line of defense for the people of the United States. The first principle of modern sanitary strategy is to destroy the germs of disease at their foci and not allow them to spread. The work of the Servian Sanitary Commission will make easier the work of the U. S. Quarantine Service. This is but the beginning of a very important movement aimed at such diseases as typhus fever, cholera, the plague, typhoid fever, and the like, which in past generations have followed the lines of trade and made an aftermath of death for every great war.

Engineering Advice in Public Utility Cases

IN AN ADDRESS by former Mayor James Logan, of Worcester, Mass., upon "The Public Service Corporation and the Municipality," printed in the current "Journal" of the Boston Society of Civil Engineers, the disadvantages to municipalities of inadequate engineering advice on large public questions are admirably set forth. It is a question if the public as a whole has the faintest realization of the odds against it in conducting cases before State commissions and legislative committees. Certainly many boards of aldermen and of selectmen still look upon an outlay for expert advice in such proceedings as an extravagance. The lack of this advice is hampering many municipalities seriously in their dealings with public utilities and with State authorities; it is throwing a great burden of additional work upon public service commissioners, and its omission in important cases is a grave mistake.

The need of expert advice in no sense impugns the ability of the permanent engineering staff of a municipality, nor does it justify attacks on the public utilities for their successful work before the public tribunals. Improper methods have within late years largely disappeared, and the real cause of failure on the part of a city to obtain its reasonable desires from State authorities is usually the superior preparation of its adversaries. Too often it happens that owing to changes in the personnel of a city government, complex questions have to be wrestled with by new men who have practically no knowledge of the past conditions, while opposed to them are organizations which have had a continuous management for years, with a fixed, persistent, well-defined policy. The utility's side of the case is conducted by the ablest talent money can buy, by men who may have been present at the birth of the problems under discussion, and who have been familiar with every stage of their development. Moreover, the city's plan or request may not have general support from the citizens and to this broken front the utility is able to present a solid defense, thoroughly intrenched and protected, manned by men who know every move the city has made or is about to make. Without the slightest trace of corruption, these well-organized forces develop a case which is hard to beat, and over and over again, only the wisdom and experience of the public authorities have saved the day for communities which have made out a showing which would have failed utterly in the courts, but which none the less had merits entitling its advocates to concessions or to a favorable decision. Furthermore none can criticize the utility for its careful preparation. It is its right, and its duty to its stockholders, to present its side of the case as strongly as possible and to marshal to its support all the legitimate corroborative data obtainable.

The city or town which follows the policy of presenting such cases without expert assistance, when the amounts involved are considerable, cannot expect, in legislative committees at least, the results to which it is often entitled. In a grade-crossing situation, for example, the municipality may have a good city engineer, but the problem may be the first important one of the kind that has come to him, and on the other side will be a body of engineers who have fought to a finish probably scores or perhaps hundreds of grade-crossing cases, who know precisely what they want, how to impress the committee with the facts bearing on their side and who can draw from outside, in support of their contentions, a mass of data beyond the reach of anyone but a specialist. The retention of such an expert by a city, even at a cost of a good many thousands of dollars, puts it in a place to fight its case on an even basis with its highly prepared antagonists, and wonderfully unifies the public contention.

Cracking of Brick Pavements

IT IS the common belief that in many of the cases where cement-grouted brick pavements have cracked to quite an extent the trouble is due to the repeated rise and fall of the pavement, on account of temperature expansion across the entire width of the street or road. Of course, settlement of the base and the washing away of the cushion rightfully come in for their share of the blame. The arching theory is held to be substantiated by the rumble heard when a wagon goes over the pavement, indicating, so proponents of the theory claim, a large hollow area. For somewhat over a year Mr. Mont Schuyler, engineer in charge of the testing laboratory of the city of St. Louis, has been making a special study of this subject and has reached the conclusion, which seems indisputably borne out by examination, that the rise of the pavement, or rather the existence of a space between the cushion and the bottom of the block, is confined to comparatively small isolated areas. These areas may be separated by narrow solid areas, so that the continuous rumble is due to the length of wheel base, which spans the solid spaces, leaving either front or rear wheels or both on the unsupported spot.

These conclusions have been reached after sounding pavements with a hammer. The hollow spots are readily and unmistakably located. If the method be tried on a pavement which is cracked and apparently has spots that have settled due to the breaking of the cement-grout bond, it will be found that the blocks which are now acting as isolated units have settled back on their beds. Surrounding them are bricks carried as cantilevers, with a space below. The bond, however, is still intact, though it may be beginning to show signs of distress. Beyond these are blocks with a solid bearing on the cushion. Other hollow spots will be found where the bond is entirely intact and without any settled bricks in the center, and this will be the condition in a newly laid pavement. Mr. Schuyler believes that it can be safely predicted that it is in these spots that the pavement will begin to fail, a conviction borne out by the limited number of observations which he has been able to follow through since the theory was first formulated. On a pavement laid in St. Louis last year he made a careful "hammer survey," and indicated the spots where this disintegration was to be expected. Troubles where they have developed are invariably in the spots designated.

The facts established, one seeks naturally for the explanation. Mr. Schuyler believes that it is due to the unequal shrinkage of the cushion, which is traceable to the unequal moisture content. It is well known that even small changes, 2 to 4 per cent, in moisture content of sand makes as much as 10 to 15 per cent change in volume, and this change in volume, affecting cushions of even uniform thickness in isolated spots, would be sufficient to account for the support of certain areas and the space below others. Variations in amount of moisture in the cushion are accounted for by conditions in the sand bank, where the moisture frequently varies from zero to 5 per cent within a radius of a few feet.

In support of his theory Mr. Schuyler points to a brick-paved street in St. Louis, in which limestone screenings were used for the cushion. Tests have shown that moisture has, relatively to sand, little effect on the volume of these screenings. Though the cushion is 2 in. thick the street after several years of service shows no cracks, in striking contrast with those with sand cushions.

With reference to the theory that there is arching from curb to curb, Mr. Schuyler states that in no case has he been able to find any disturbance or compression in the so-called expansion joints at the curbs. He terms them, rather, lubricating joints, allowing the pavement to settle as the cushion loses its moisture. Furthermore, where pavements have been run up to the curb and the joint grouted there is frequently a crack in the bricks near the curb, indicating that they have been prevented from settling with the remainder of the pavement.

The theory propounded, if accepted, leads to an inquiry for a type of cushion which is not affected by moisture. The mortar type now being used in several cities would seem to offer a satisfactory solution, for while there is some change in volume of mortar with varying changes of moisture content, the change is negligible. This would be a still further argument for this type of cushion, or bedding. Its other advantages lie in holding the brick more firmly and in preventing the displacement of the support, which may happen where plain sand is employed.

The subject warrants further investigation and holds surprises to those who are willing to sally forth, hammer in hand, to search out the ailments of their brick roads.

Operating Records of Atlanta Sewage Treatment Plant Show Adequate Degree of Purification

Troubles with Scum in Tanks and Foaming in Gas Vents Are Overcome at Proctor Creek Works, One of the Pioneer Imhoff-Tank Installations in the United States—Fine Screening Abandoned

By CHARLES C. HOMMON
Chemist and Bacteriologist in Charge of Sewage Treatment Plants, Atlanta

OPERATING records of one of the pioneer Imhoff-tank sewage treatment works in the United States, the Proctor Creek plant at Atlanta, Ga., which was placed in service Aug. 8, 1912, and comprises grit chambers, Imhoff tanks, a revolving fine screen, sprinkling filters and sludge-drying beds, have now extended over a period sufficiently long to justify the definite conclusion that the works have fulfilled the function for which they were designed—the elimination of nuisances in the form of foul odors, floating débris, and sludge accumulations in the stream bed. In fact, there is no longer any evidence of sewage in the creek at any time of the year, for the plant effluent has a high relative stability figure and contains a large amount of free oxygen. In the maintenance of the works, particular attention has been given to the Imhoff tanks, where measures are taken to remove scum, prevent foaming in the gas vents, and draw off sludge at the proper intervals. Very little trouble from clogging of the sprinkler nozzles at the filters has been experienced, in spite of the fact that the operation of the fine screen was discontinued soon after the plant had been placed in service. Costs of operation have been kept and average $3.93 per million gallons, exclusive of interest on investment and depreciation.

The Proctor Creek plant is one of Atlanta's three sewage treatment works, the others being located on Intrenchment Creek and Peachtree Creek. They are all of the same general type and the Peachtree Creek plant was described in detail in the Engineering Record of Dec. 31, 1910, page 769. The sewerage improvements in Atlanta were undertaken by the advice of Capt. R. M. Clayton, and the designs of the treatment plants were prepared by the firm of Hering & Fuller, consulting engineers, of New York City.

The Proctor Creek works have been in service longer than any of the others, and it is with the operation of this plant that this article deals.

INDUSTRIAL WASTES IN SEWAGE

The principal industrial wastes received are from the Atlanta gas works, the Prest-o-lite Gas Company, and the American Tin Can works. None caused any trouble at the plant except the wastes from the gas works, which contained tar. The company, however, installed tanks especially designed to remove the tar and oil, and no serious trouble has resulted from the sewage from these works.

The waste from the Prest-o-lite Gas Company consists principally of spent calcium carbide, $Ca(OH)_2$. It forms a heavy flocculent precipitate in the sewage, and except for increasing the sludge and causing the sewage to appear white it does not cause any trouble. It is discharged into the sewer two or three times a day, and the white color is very noticeable at the plant for a period of 30 min. after each discharge.

The trade waste from the American Tin Can works is discharged into the sewer only on Saturday afternoons. It consists mostly of weak pickling liquors, largely sulphuric acid that is used for removing scale from the tin and iron. Before the pickling liquors are discharged they are diluted with sufficient water to prevent any action by the acid on the sewers. These pickling liquors contain an appreciable amount of ferrous iron in solution, which forms hydroxides with the alkaline sewage and causes the sewage to have a brown color, which can easily be detected when it reaches the sewage treatment works. The iron wastes are probably an advantage, as the flocs that are formed assist in removing the suspended matter in the Imhoff tanks. The iron that is in solution and does not settle in the Imhoff tanks is oxidized in the sprinkling filters and only a small portion of the iron reaches the outlet.

EQUIPMENT AND METHOD OF OPERATION

The intercepting sewer to the Proctor Creek plant terminates in a rectangular chamber 8 ft. long, 4 ft. wide and 7 ft. deep and has a 12-in. connection to the stream. This basin was designed to remove the coarser sand that is carried along the bottom of the sewers and has a detention period of about 1 min. From three to four times a day the valve on the 12-in. connection to the creek is opened and the accumulated sand is flushed out. This has been found to be a very economical method of removing the coarser sand, and by careful manipulation only a very small amount of untreated sewage is discharged into the creek.

After passing through this preliminary grit chamber, or sand-trap, the sewage passes through a screen made of 3/8-in. bars, spaced 2 in. center to center, and is laid at an angle of 45 deg. downstream. This screen removes pieces of wood, dead animals, rags and other débris which find their way into the sewers at all times and in large quantities during storm flow. The screenings removed average about 30 lb., wet, per million gallons of sewage, and they are disposed of by burying.

GRIT CHAMBERS

There are three grit chambers for removing the finer sand that is not deposited in the first grit chamber, or sand-trap. They are operated so that there is always one ready for use, one draining and one in operation. The velocity of the sewage while passing through the grit chamber is about 1 ft. per second, and tests have shown that at this velocity practically all of the sand is deposited, and that little organic matter settles out. A part of the sand is used for resurfacing the sludge bed and the excess is hauled away to a dump. When piled up it does not create a nuisance, and after a short time the sand throughout the pile becomes dry. The quantity of sand deposited in the grit chambers amounts to about 0.3 cu. yd. per million gallons of sewage treated. It costs about 16 cents per cubic yard to remove the sand from the grit chambers and haul it 100 ft. to a dump.

IMHOFF TANKS

There are twelve Imhoff sedimentation tanks arranged in series of three, that receive the sewage from the grit chamber. There is provided what is called a cross-over channel so that the sewage can be admitted to the tanks from either end and thus get an even distribution of sludge over the bottom of each tank. In practice the sewage is applied to one end of each series of the tanks for a definite period of time and then the flow is reversed and the sewage passed through the tanks from the opposite end for a definite period. This method has given very good results and approximately equal amounts of sludge are removed from each section of the series. The direction of flow is reversed about once every month.

TANKS SKIMMED OFTEN

Great care is taken to keep the surface water of the settling compartments of the tanks free from floating material. This is done by frequently skimming. The floating material is driven to one side of the tanks by means of water from a garden hose and then removed with a large skimmer. The skimmings consist mostly of small particles of grease, corks, matches, etc. The skimmings amount to about 33 lb. per million gallons of sewage treated, figured on a wet basis, or just as the material is removed from the tanks. They are carted off and buried.

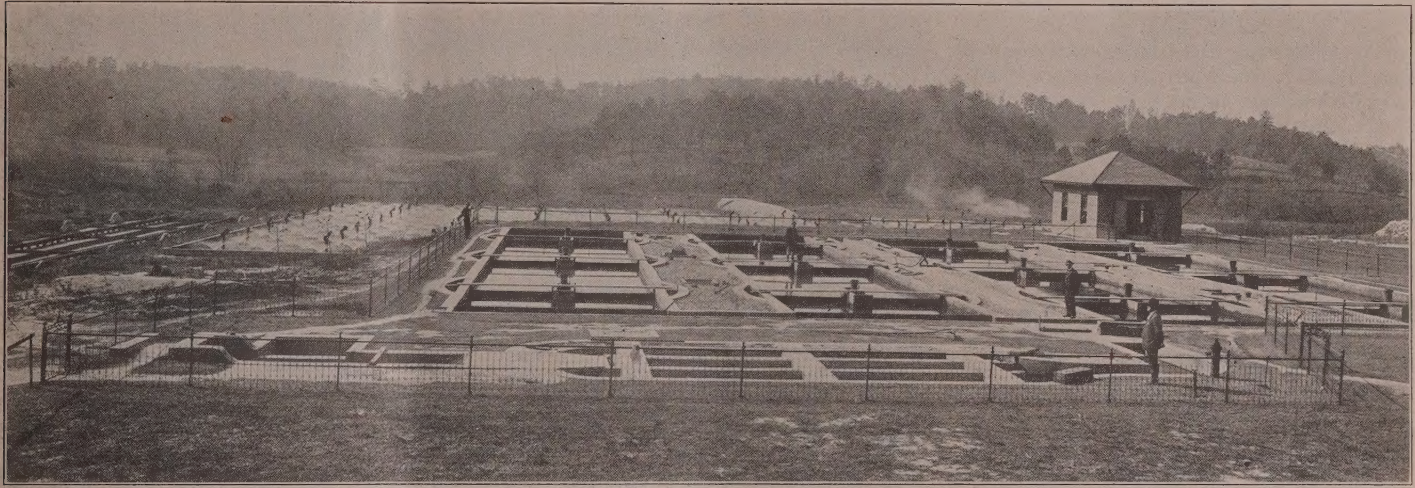
The sloping walls that separate the sludge well from the settling compartment of the Imhoff tanks are scrubbed on an average twice a week. This is done by means of a 12-in. wire street-sweeping broom fastened to the end of a 20-ft., 3/4-in. pole. An arrangement of this sort can be handled with ease and is very effective, and the time required for scrubbing the sloping walls is about one hour per tank per week.

SCUM FORMS IN GAS VENTS

During the first three months of operation little material collected in any of the gas vents. At the end of three months, however, a scum began to form in the outside gas vents of each tank, while the central vent remained comparatively clean. The water beneath was black and odorless. The scum gradually became thicker until at the end of six months it was 15 in. thick. The upper surface was quite dry and firm, some of the material being packed in tight enough to hold up the weight of a man. It was thought that this might interfere with the escape of gas so all of the gas vents were cleaned of this solid material. They remained clean only for a short time, however, and at the end of six months they were in the same condition, and had to be cleaned again. They have been cleaned four times since the plant has been in service.

The central gas vents have caused little trouble. They were cleaned once and after that the material that rose to the surface floated for awhile and sank again to the bottom. There is a small amount of floating material on the surface of the central vents all of the time, but it never forms a thick scum, and as it does not interfere with the escape of gas it has never been removed after the first time.

After the Imhoff tanks had been in service about five months the gas vents began to give trouble by foaming or boiling over. The gas bubbles as they arose from the sludge well seemed to be covered with a soapy or greasy film that did not break on reaching the surface of the tanks, but continued to build up on top of one another until they overran the sides of the gas vents. The gas bubbles did not carry over enough suspended material to lower the efficiency of the tanks materially, but they did make the tanks look very unsightly.



THE ATLANTA PLANT, PLACED IN SERVICE IN AUGUST, 1912, IS ONE OF AMERICA'S PIONEER IMHOFF-TANK INSTALLATIONS

Several methods were tried to prevent the gas from bubbling over, one of which was to build the gas vents up higher. One vent was built up 6 ft. and the bubbles ran over this, and to all appearances would have gone higher so the idea was abandoned. The next method was to spray water into the gas vents, but this only produced a temporary relief and had to be applied several times a day in order to keep the bubbles within the vents. Finally sludge was drawn from one of the tanks that had been causing trouble from foaming and as soon as the sludge was removed the gas bubbles that rose from the sludge well broke on reaching the surface of the water. It has been observed since then that as soon as the sludge well is almost filled with sludge the gas bubbles do not break on reaching the surface and the gas vents begin to foam.

The explanation of this phenomenon seems to be that when the sludge reaches a certain point in the sludge compartment, near the slots, the gas rising from the sludge carries enough particles with grease to cause the film holding the gas bubbles to become elastic and tough, while the gas bubbles rising from the greater depths through the sewage are washed free from the particles of grease and consequently break on reaching the surface. The general plan now is to draw sludge from the tanks as soon as they start foaming, and there is no longer any trouble from the gas vents foaming or boiling over.

SLUDGE REMOVAL

The Imhoff tanks were in service from Aug. 8, 1912, to Jan. 9, 1913, before any sludge was drawn out, thus making an initial ripening period of five months. The first sludge drawn was of a good quality, and it has been of a good quality ever since. It is black in color and has a slight tarry odor when held close to the nose. When the sludge is distributed on the sludge bed not over 6 in. deep it dries into spadable material in from seven to nine days, depending on the weather conditions. When first drawn from the tanks it contains from 80 to 85 per cent water. Care is taken not to draw out any more sludge than is necessary during the winter months, because of the unfavorable drying conditions. During the summer months small amounts of sludge are drawn from each tank every ten days or two weeks, rather than larger amounts at longer intervals. It has been found to be better practice to put sludge on the drying bed about 6 in. deep and remove it quickly, than to put it on thicker and take the risk of getting it wet by rain.

The aim is to have all of the digested sludge out of the tanks before winter sets in so as to have enough storage capacity to carry each tank through the winter.

For reasons of economy only a small part of the sludge has been dried on the sludge beds. The city owns 20 acres of land, just below the sludge beds, that were to be used as a dumping ground for the dried sludge. This area is about 2 ft. below the level of the bed, thus making it very easy to let the sludge run directly onto the bottom land and dry out. This saves the expense of removing it from the sludge drying beds and carting it away in cars. By this means of disposal it is impossible to get any accurate data as to amount of sludge deposited in the tanks. It costs about 20 cents per cubic yard to dry and remove sludge from the artificial beds and haul it 100 yd.

GASES OF DECOMPOSITION

Most of the gas formed in the sludge well escapes through the center vents, and it is most active in those tanks receiving the largest quantity of sludge—that is, the inlet section of the series of three tanks. There is no odor of hydrogen sulphide noticeable when standing near the vents, even when the ebullition is most active. The largest quantity of gas is produced during the warmer months, the quantity gradually decreasing as the sewage becomes cold, but at no time does it disappear entirely.

TABLE 1.—ANALYSIS, IN PERCENTAGES, OF GASES COLLECTED FROM VENTS OF IMHOFF TANKS

Sample	Carbon Dioxide	Oxygen	Hydrogen Sulphide	Methane	Hydrogen	Nitrogen
1...	4.7	0.3	0.0	85.3	9.7	0.0
2...	5.2	0.5	0.0	82.8	8.2	3.3
3...	4.4	0.6	0.0	84.2	7.9	2.9
4...	4.2	0.4	0.0			
Average	4.6	0.4	0.0	84.1	8.6	3.1

EFFICIENCY OF IMHOFF TANKS

As will be noticed by referring to Table 2, the Imhoff tanks are doing very satisfactory work. While these determinations, made by the Imhoff settling glass, do not cover a very long period they show with fair accuracy the amount of settleable material in this particular sewage on the above dates. A two-hour settling period was used in making these tests and the theoretical settling period in the Imhoff tanks is three hours. These results would tend to show that the tanks could be operated with a shorter storage period and still give good results, but in the tests the sewage in the settling glasses remained quiescent for two hours, while there was a forward movement in the tanks tending to keep the lighter suspended particles from settling as quickly there as in the settling glasses. Furthermore, it is impossible to obtain complete displacement in the tanks, so that the actual storage period is less than the theoretical, and the tanks are probably operating at the shortest storage period possible consistent with the high per cent of removal now obtained. Settling experiments on the tank effluent have been made from time to time with the Imhoff conical glasses, and there has never been any settleable material noted. The suspended matter in the tank effluent that is recorded in Table 3 consists mostly of colloidal material, which would never settle out by its own weight.

REVOLVING SCREEN DISCONTINUED

The sewage, after passing through the Imhoff tanks, goes to a Weand revolving cylindrical screen. This screen was installed for the purpose of screening out of the tank effluent any large particles that

TABLE 2.—RESULTS OF EXPERIMENT TO SHOW AMOUNT OF SETTLEABLE MATERIAL IN CRUDE SEWAGE AND EFFLUENT FROM IMHOFF TANKS

Sample	Time Collected	Settling Period, Hours	Cu. Cm. Settleable Material per Liter Crude Sewage	Cu. Cm. Settleable Material per Liter Effluent Imhoff Tanks
MARCH 6, 1913				
1.....	9.30 a. m.	2	3.5	0.0
2.....	10.30 a. m.	2	6.0	0.0
3.....	11.30 a. m.	2	16.0	0.0
4.....	12.30 p. m.	2	17.0	0.0
5.....	1.30 p. m.	2	6.0	0.0
6.....	2.30 p. m.	2	1.7	0.0
7.....	3.30 p. m.	2	1.7	0.0
8.....	4.30 p. m.	2	3.5	0.0
March 7, 1913				
1.....	8.00 a. m.	2	0.7	0.0
2.....	9.00 a. m.	2	10.0	0.0
3.....	10.00 a. m.	2	13.0	0.0
4.....	11.00 a. m.	2	4.7	0.0
5.....	12.00 m.	2	11.0	0.0
6.....	1.00 p. m.	2	7.5	0.0
7.....	2.00 p. m.	2	10.0	0.0
8.....	3.00 p. m.	2	3.5	0.0
9.....	4.00 p. m.	2	3.8	0.0
March 8, 1913				
1.....	11.00 a. m.	2	45.0	0.0

would tend to clog the nozzles of the sprinkling filters. The cloth on this screen has thirty-six meshes to the linear inch and has a screening area of 150 sq. ft. It is operated by a 3-hp. motor and cleaned by water under pressure.

The screen was operated for about two weeks when the plant was first put into service, but it was found that there was not enough clogging material in the tank effluent which the screen would catch to justify the expense and trouble of running it. There was collected only about 0.7 lb. of screenings per million gallons of sewage screened.

FILTER BEDS

The filter beds are in two units, one of 1 acre in area and one of 0.5 acre. The beds are filled to a depth of 6 ft. with crushed granite, ranging in size from stones 1½ to 2½ in. The underdrains are of half-tile set in concrete.

The sewage is applied to the filter beds by two 24-in. Miller automatic siphons. The time between two consecutive doses averages fifteen minutes; the time the nozzles are discharging each dose is about three minutes and the rest period between doses is about twelve minutes. The rate at which the sewage is treated during the dosing period is 10,000,000 gal. per acre per twenty-four hours and the net rate per twenty-four hours is 2,000,000 gal. per acre per twenty-four hours. The filters are operated continuously except for the rest period between the discharges of the siphons, and the number of discharges of the siphons depends on the volume of sewage flowing at any particular time.

There has been but very little trouble due to the clogging of nozzles. A small amount of grease collects in the risers and occasionally this forms little balls which throw the spray to one side of the nozzle, but trouble from this cause is negligible and one man can take care of all the beds in fifteen minutes each day.

CLOGGING OF FILTERING MATERIAL

As will be noted by referring to the suspended matter in Table 3, during the first twenty months of operation there was no noticeable unloading of the filtering material. During the months of January and February and the first part of March, 1914, both filter units were badly clogged. In places the water stood ½ in. deep on the surface. During the latter part of March both units began to unload and by the first part of April the filter effluent looked much worse physically than the tank effluent and contained large quantities of suspended matter, the highest quantity being 139 parts per million. The filters continued to unload until May, when the suspended matter in the effluent gradually became less. The improvement continued until operation was normal and the voids in the filtering material had become practically free from accumulated suspended matter. After unloading, the beds were practically as clean as when they were filled with the stone except for the upper 6 or 8 in. which has a slight accumulation that has been formed since the bed stopped unloading.

Since the plant is not equipped with final settling basins all of the clogging material that was washed from the filter beds had to pass directly into the creek with the filter effluent. However, at no time during the interval the beds were unloading did the creek water below the plant become offensive.

TABLE 4.—ANALYSIS OF MATERIAL COLLECTED FROM WEAND SCREEN

Material	Per Cent
Water	24.2
Solids (dry)	75.8
Volatile matter (on dry basis)	88.5
Fixed matter (on dry basis)	11.5
Nitrogen (on dry basis)	1.1
Ether soluble matter (on dry basis)	55.4

TABLE 5.—ANALYSIS OF SLUDGE REMOVED FROM IMHOFF TANKS

Specific Gravity	Per Cent Moisture	Per Cent Vol.	Per Cent Fixed	Per Cent Nitrogen	Per Cent Fat
....	88.7	45.0	55.0	1.16	9.76
....	88.3	33.3	66.7	1.26	6.92
....	79.3	28.0	72.0	....	7.34
1.02	87.8	38.6	61.4	1.44	6.84
1.05	84.2	42.2	57.8	1.28	6.42
1.02	87.6	39.9	60.1	1.28	5.84
1.03	87.7	35.5	64.5	1.12	4.0
1.03	90.2	37.9	62.1	1.2	7.14
1.02	86.2	38.5	61.5	1.28	11.12
....	86.3	39.7	60.3	1.28	10.0
1.0	87.7	42.5	57.5	....	....
1.01	90.0	37.1	62.9	....	....
1.0	87.0	45.0	55.0	1.28	8.5
....	87.7	44.0	56.0	....	....
9.18	1,218.7	547.2	852.8	12.58	67.23
Average:					
1.02	87.05	39.1	60.9	1.25	6.11

With the coming of warm weather in the spring of 1913 and 1914 there appeared on the under surface of the stones the larvæ of a fly that later developed into a small gray white fly, belonging to the genus psychoda. During May and June there were great numbers of these flies but they did not migrate very far from the filter beds except when driven by the wind. They remained until the middle of July, when there began to appear in the stones numerous small spiders. With the coming of the spiders the flies gradually disappeared, and it is thought the spiders fed upon them. The filter beds became thoroughly alive with the spiders and no flies were to be found.

The unloading of the filters began about the time the larvæ of the fly were first noticed, and it is quite possible that the movement of these little worms working in the deposit on the stones had some material effect in causing suspended matter to pass from the filters.

VENTILATORS IN FILTER BEDS

No special studies were made to determine the effect of the ventilators (see illus-

TABLE 3.—PROCTOR CREEK SEWAGE TREATMENT PLANT, MONTHLY AVERAGE ANALYTICAL RESULTS

	Crude Sewage—Parts per Million										Imhoff Tank Effluent—Parts per Million										Sprinkling Filter Effluent—Parts per Million										
		Nitrogen as					Suspended Matter					Nitrogen as					Suspended Matter					Nitrogen as					Suspended Matter				
Date	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Relative Stability
1913																															
Jan.	62	14.4	18.6	0.1	2.0	....	317	154	163	44	60	13.2	21.3	0.1	1.9	....	89	50	39	33	56	3.9	12.2	0.8	6.4	....	60	31	28	76	98
Feb.	61	14.6	19.3	0.1	2.6	....	230	98	112	47	58	11.4	21.3	0.2	3.1	....	90	42	41	41	55	3.1	14.2	0.7	7.2	....	55	26	28	68	96
Mar.	63	10.4	16.9	0.1	3.0	78.3	222	...	...	33	61	7.1	16.8	0.2	2.8	60.0	77	..	..	39	59	2.7	8.4	0.5	9.4	25.0	58	..	..	66	97
Apr.	65	11.1	16.6	...	2.7	89.3	266	...	...	22	64	6.5	18.6	...	2.1	59.2	60	..	..	26	62	2.8	6.2	...	9.7	23.6	42	..	..	65	99
May	70	10.9	18.0	...	2.3	....	291	...	...	24	70	7.2	19.1	...	2.1	....	60	..	..	22	70	2.6	6.8	...	8.7	....	33	..	..	59	..
June	73	11.3	19.6	...	1.6	....	266	...	...	18	72	6.7	20.9	...	1.2	....	65	..	..	24	74	3.8	8.6	...	7.9	....	51	..	..	52	88
July	77	11.6	16.5	...	1.4	....	290	...	...	11	76	7.1	19.0	...	1.1	....	58	..	..	21	78	3.8	8.2	...	5.8	....	56	..	..	52	94
Aug.	75	....	....	...	...	....	...	...	...	12	78	....	....	...	...	....	..	..	..	28	79	...	....	...	...	....	..	..	..	65	99
Sept.	76	....	....	...	...	....	...	...	...	26	75	....	....	...	...	....	..	..	..	38	74	...	....	...	...	....	..	..	..	71	99
Oct.	71	13.8	21.8	...	2.6	....	371	...	...	29	70	10.6	21.9	...	2.4	....	55	..	..	39	68	5.6	11.4	...	11.3	....	48	..	..	62	99
Nov.	68	15.6	20.9	...	2.2	95.0	296	...	...	38	66	10.7	19.9	...	2.3	53.1	68	..	..	41	61	4.2	10.7	...	8.9	24.2	42	..	..	69	99
Dec.	65	14.8	18.9	...	2.1	100.0	302	...	...	41	63	9.2	21.1	...	2.3	68.0	56	..	..	43	57	3.3	12.7	...	7.0	32.1	44	..	..	63	99
Av'ge	70	12.8	18.8	0.1	2.2	90.6	285	126	138	28	68	9.0	20.0	0.2	2.1	60.1	68	46	..	33	66	3.8	9.9	0.7	8.2	28.2	49	28	28	64	89
Max.	77	15.6	21.8	0.1	3.0	100.0	371	154	163	47	78	13.2	21.9	0.2	3.1	68.0	90	50	..	41	79	5.6	14.2	0.8	11.3	32.1	60	31	28	76	99
Min.	61	10.4	16.5	0.1	1.4	78.3	222	98	112	11	58	6.5	16.8	0.1	1.1	53.1	35	42	..	21	55	2.6	6.2	0.5	5.8	23.6	33	26	28	52	88
1914																															
Jan.	63	15.2	20.5	...	1.7	....	279	...	...	42	60	9.2	21.7	...	1.9	....	64	..	..	48	55	5.7	14.6	...	5.2	....	40	..	..	62	99
Feb.	60	15.3	18.1	...	2.2	....	302	...	...	48	58	9.2	18.0	...	2.0	....	60	..	..	46	57	6.1	12.5	...	4.5	....	41	..	..	58	96
Mar.	61	16.9	29.3	...	1.6	....	431	...	...	34	59	10.3	27.6	...	1.8	....	73	..	..	46	55	8.5	19.5	...	3.6	....	71	..	..	55	89
Apr.	67	9.5	30.4	...	2.0	....	360	...	...	12	66	9.0	28.8	...	1.5	....	68	..	..	41	64	6.0	20.7	...	6.1	....	106	..	..	58	90
May	72	12.4	33.4	...	2.3	....	385	...	...	22	71	7.1	30.0	...	1.7	....	73	..	..	35	71	4.5	17.4	...	9.1	....	82	..	..	79	98
June	74	10.9	29.9	...	2.0	....	308	...	...	22	77	4.7	30.3	...	1.8	....	67	..	..	34	77	4.8	13.1	...	10.7	....	51	..	..	76	99
July	..	13.6	28.0	...	2.0	....	393	...	...	..	..	4.1	25.0	...	2.0	....	49	..	..	..	..	4.4	8.8	...	11.2	....	42	..	..	..	..
Av'ge	66	13.4	27.1	...	2.0	....	351	...	...	30	65	7.7	25.9	...	1.8	....	65	..	..	42	63	5.7	15.2	...	7.2	....	62	..	..	65	95
Max.	74	16.9	33.4	...	2.3	....	431	...	...	48	77	10.3	30.3	...	2.0	....	73	..	..	48	77	8.5	20.7	...	11.2	....	106	..	..	79	99
Min.	60	9.5	18.1	...	1.6	....	279	...	...	12	59	4.1	18.0	...	1.5	....	49	..	..	34	55	4.4	8.8	...	3.6	....	40	..	..	55	89

tration on front cover) in causing air to circulate through the filters. It has been observed, however, that there is a downward draft of air through the ventilators when the wind is blowing and an upward draft when there is no wind. From the chemical analysis it will be seen that the nitrification has been uniformly good. The dissolved oxygen results, while not showing saturation, have been normal at all times in samples freshly taken from the beds, and the fact that there was oxidation going on so actively in the filters accounts for the difference in the results found and the required amount of oxygen for saturation.

Cost of Operation

From the time the Proctor Creek plant was put into operation the cost of treating the sewage per million gallons has been $3.93. This includes salaries, expenses of operation, such as repairs, renewals, water and electricity, but does not taken into account interest on investment or depreciation.

Conclusion

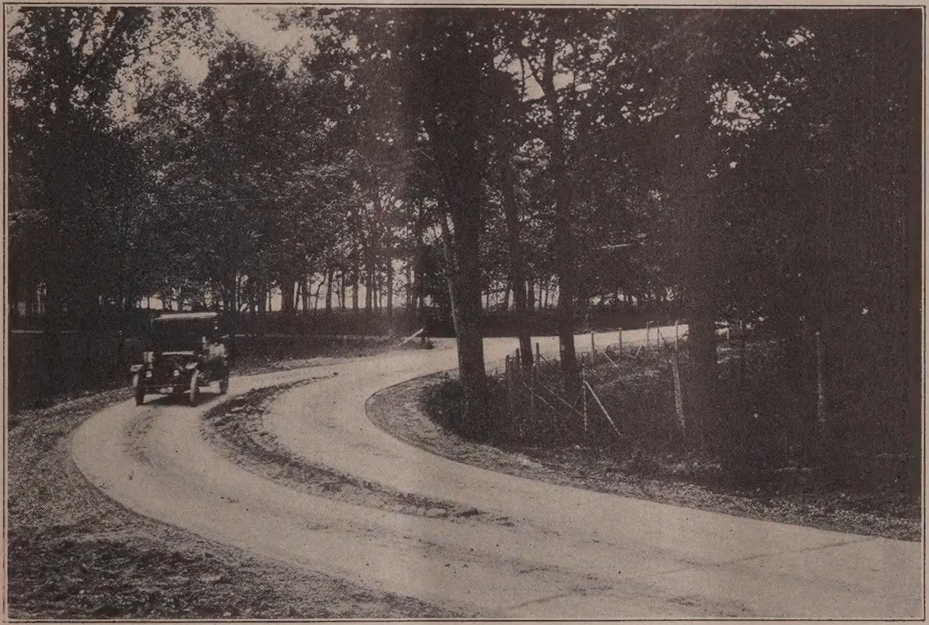
When the sewage treatment plants for Atlanta were under discussion the designing engineer's plans were to carry the purification of the sewage to such a degree that the final effluent would be free from all objectionable floating material and equal in quality to the stream into which it was discharged. As will be noted by referring to Table 3, the final effluent has a high relative stability figure and contains a large amount of free oxygen.

Before the sewage treatment plant was put into service Proctor Creek, which carried the raw sewage away from the outskirts of the city, was in a very bad condition. There were sludge banks, rags and other débris from sewage and the bed of the creek was black. The odors were offensive during the summer months and there was a general dissatisfaction among the people living along the stream. Since the plants have been in operation the water in the creek has become clear and there are no complaints from nearby residents. The sludge banks have disappeared, the bed of the creek is no longer black and there is no evidence of sewage in the creek at any time of the year.

The writer wishes to acknowledge the hearty co-operation and generous support of Capt. R. M. Clayton, chief of construction; W. A. Hansell, Jr., former assistant chief of construction, and H. N. Hurt, the present assistant chief of construction, in all things connected with the successful operation of the Atlanta sewage treatment works.

Split Road on Curve Forces Autoists to Keep to Right

SEPARATION of a concrete road into two parts on a moderately sharp curve lying on a 5 per cent grade is a "safety first" innovation in road construction in Minnesota. The object of the split road, states John Mullen, deputy State engineer, is to prevent possible accidents due to the tendency of drivers to hug the inside of the curve regardless of the direction in which they are going. As illustrated by the accompanying photograph, the road at the turn consists of two strips 8 ft. wide, separated by a crescent-shaped opening. On tangents the concrete slabs are 16 ft. wide.



SPLIT ROAD PREVENTS LEFT-HANDED CROWDING OF INSIDE OF CURVE

The divided roadway was not considered especially successful at first, as the 8-ft. width of each track was found insufficient. One of the divisions has since been increased to a 10-ft. width, and with this additional width Mr. Mullen is of the opinion that such construction is an extremely good insurance against accidents on sharp curves where the road can be seen only a short distance ahead.

WATER METERS IN LONDON, ONTARIO, numbered 2562 Jan. 1, 1915, an increase of 486 during the previous year. Only 17 per cent of services are metered, although 24 per cent of the water consumed passes through meters and furnishes 40 per cent of the revenue. Each inhabitant of this town of 56,000 population consumes on the average 81 Imperial gallons per day and the cost of supplying water is $34.15 per 1,000,000 gal.

Five 4-Foot Water Mains Underpinned After Break

Large Yardage of Excavation Rapidly Removed by Hand and Street Car Tracks Supported While Girders Are Built to Carry New York Pipe Lines

TEARING up an entire city block in New York City to repair five large cast-iron mains, in one of which a break occurred June 3, involves an unusual problem simply in getting rid of and then replacing the dirt. Conditions were further complicated at Manhattan Avenue between 109th and 110th Streets where all of the mains had settled, by the necessity for maintaining double-track street car traffic over the excavation. A description of the break in one of these mains, which feed the Central Park reservoir from the Croton supply, will be found on page 757 of the Engineering Record of June 12.

Where a break of this kind occurs the important thing is to restore conditions in the shortest possible time consistent with doing a good job. There is no time to set up plant or deck the street. The first step taken on this work was to tear up the pavement and put timber stringers under the car-tracks in place of the supports which had been damaged by the break. These supports had been built down to the old rock fill, over which was a blanket of clay in which the mains were laid.

When traffic over the car tracks had been provided for, the whole street was excavated to the bottom of the mains as rapidly as possible by hand. The street surface had been undermined until it was unsafe for teams, so carts were driven on the sidewalks beside the excavation after plank had been laid to protect the surface. Material was stored on adjacent streets for backfill by building walls of the broken concrete pavement base and dumping the carts between them.

Concrete Girders to Support Pipe

It was found that enough of the clay around the mains had been washed out to allow them to settle from the south curb of 109th Street to the center of 110th Street. Reinforced-concrete cross girders on 6-ft. centers have been placed under the pipes for this distance, and are carried on concrete footings excavated down to the old rock fill, which, contrary to first conjectures, has proved to be very solid. About forty of these bents were required.

The next step after excavating to the bottom of the mains was to dig under the pipes at the site of alternate girders, or on 12-ft. centers, and lay blocks on which jacks were set, one on each side of the main. Each pair of jacks carried a long timber under the main, and each main was picked up a few inches at a time at each joint till no joint was more than ¼ in. out of plumb in its height. With the 7-in. bells with which this pipe is fitted, ¾ in. in 4 ft. is allowable. The joints were then calked by driving up the old lead. The water was turned off each main while it was raised and calked. The final calking on one main, however, was done successfully under pressure. The east main was raised 14 in. for about 70 ft. and the next main to it was raised 10 in. The others were raised less, except the one next to the west main, which broke. At the break the pipe had dropped 2 ft.

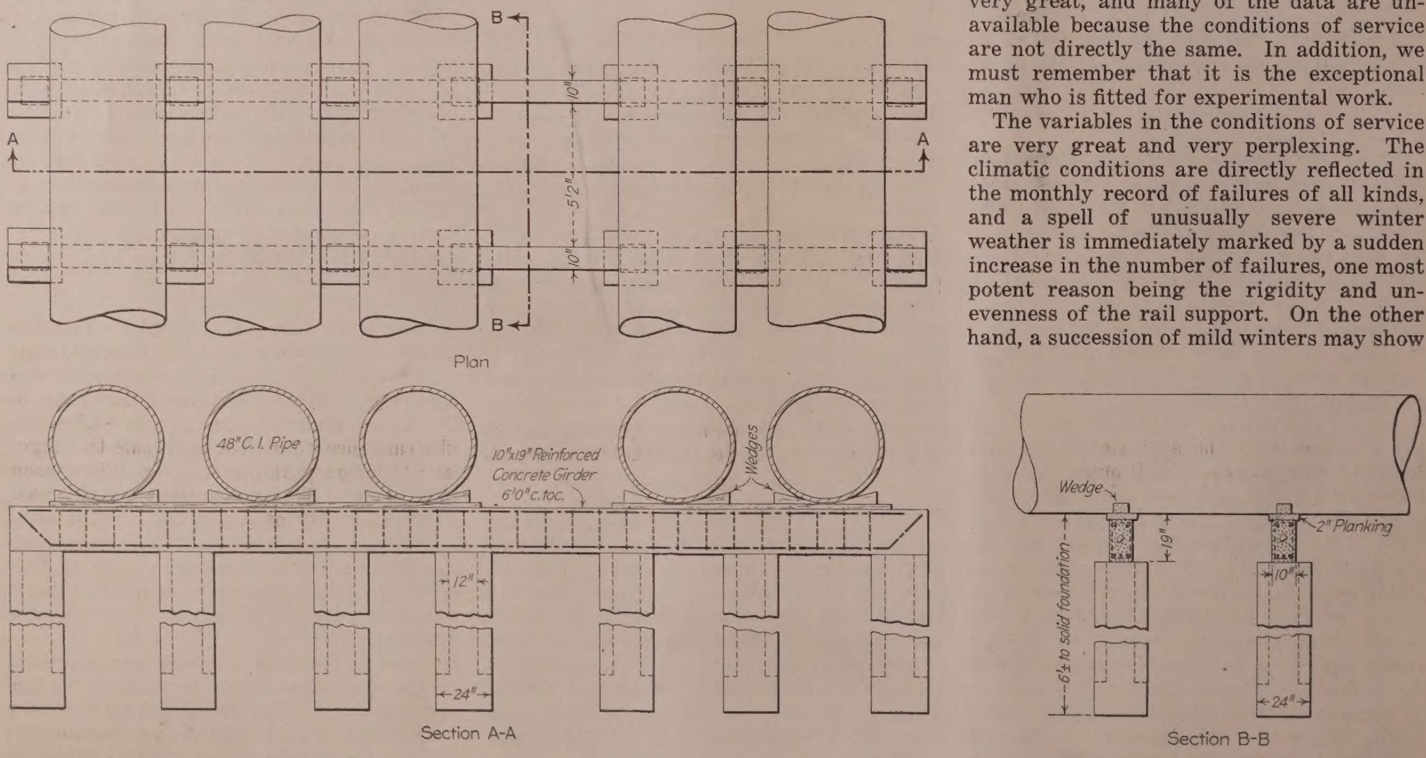
Where the break occurred, a new double-bell casting had to be set. After the ends which fitted into this casting were ready, a small derrick was set up on the car tracks at night to handle the section. The whole performance stopped traffic only two hours. While the raising proceeded the first girder trenches were dug on 12-ft. centers, alternating with the blocking. Pits from 3 to 5½ ft. deep were sunk below these trenches to the rock fill. Enough concrete to bring these pits to within about 2½ ft. of the underside girder was dumped in each hole, on top of which a ready-made box form was set and concreted. Forms for the girders were then set and poured. Concrete was mixed by hand, as materials in small lots could be delivered by team very close to the point of use. There was no chance for continuous pouring and volumes were small. Therefore a mixer brought on the job was not used.

Blocks were poured on top of the girders under each pipe, leaving a clear space of 1 to 4 in. It was thought dangerous to rest the lines directly on concrete, and hardwood wedging blocks were used for this purpose. After the lines were wedged up on the alternate beams first placed, the blocking was removed and the remaining concrete bents placed. The timber bents first set under the car tracks will next be replaced with permanent I-beams and concrete piers by the street railway forces before the street is backfilled and the paving replaced.

The concrete girder design was varied on the south side of 109th Street by two brick sewers converging into a manhole in the center of the street intersection. As the manhole drops 30 ft. or more to a trunk sewer located just over bed rock and running north under Manhattan Street, only the branches are in the way of the underpinning work. The piers were, of course, sunk to miss these branches. Where girders cross the branches there was room for a section 1 ft. deep in all but one place, where the shallow depth made it necessary to use 6-in. I-beams.

Shoring the dirt under the sidewalks proved easy, as the street car tracks furnished longitudinal ties for the 8 x 8-in. crossbracing from curb to curb. The hard clay stood very well and required no sheeting either at the sides of the main excavation or in the foundation pits.

The work is being done on force account by the Beaver Engineering Company. The Department of Water Supply, Gas & Electricity, of which Col. Merritt H. Smith is chief engineer and William W. Brush, deputy chief engineer, is furnishing all materials. Henry B. Machen, borough engineer for Manhattan, is in immediate charge of the repair work.



CONCRETE BENTS UNDERPIN WATER MAINS THAT SETTLED WHEN SLOW LEAKS WASHED OUT CLAY SOIL BENEATH THEM

Constructive Work Leading to Better Rail Specifications Urgently Needed

A. W. Gibbs Reminds American Society for Testing Materials that Little Advance Has Been Made Recently and Suggests Lines of Investigation

FEELING that there has been little progress made during the last seven or eight years in the way of securing better rails, and that the American Society for Testing Materials has failed to produce a satisfactory rail specification, A. W. Gibbs, outgoing president of the society, and chief mechanical engineer of the Pennsylvania Railroad, in his presidential address at the annual convention in Atlantic City last week, made an urgent plea for constructive committee work to meet the situation. In his estimation the specifications of both the American Society for Testing Materials and the American Railway Engineering Association are defective, but those of the former association he deems more so. He believes the chemistry of the finished rail itself, and not that of the ladle test ingot, should be the basis for determining the acceptability of the rail. He thinks it a pernicious practice to accept material if a second and third test piece pass after the first fail. He also decries the acceptance as "specials" of rails represented by unsound test pieces, and thinks the only sure way to keep them out of important service is to prevent their shipment from the mill. He is inclined to believe the time has come for a considerable increase in the weights of sections. While more or less radical changes in mill practice have been proposed, he points out that the mills cannot be expected to disrupt their sequence of operations without proof of the value of the changes sought, and to this end he suggests a small experimental mill, run by the co-operative efforts of the parties interested.

Mr. Gibbs introduced his subject by pointing out the ever-growing expenses of the railroads, which had been met by larger units, and consequently heavier loads. He saw no possibility of turning back from this course, hence the great importance of the rail problem. He then continued as follows:

In this country we are using heavier concentrated loads than are carried elsewhere. Much has been written to show the relative increases of the weights of rail and of loads carried, and conclusions have been drawn that one or the other has unduly increased. The flaw in this argument is that the contemporaneous comparisons have been of the heaviest rail and the heaviest load, forgetting the fact that the heaviest loads are few in number, and that the prevailing rail section over which they run is not the heaviest.

STATISTICS AND SERVICE CONDITIONS

Definite conclusions as to the performance of different lots of rail are difficult to draw. Statistics of actual service worthy of confidence are still young and far from complete. The labor of following the location and service of different trial orders is very great, and many of the data are unavailable because the conditions of service are not directly the same. In addition, we must remember that it is the exceptional man who is fitted for experimental work.

The variables in the conditions of service are very great and very perplexing. The climatic conditions are directly reflected in the monthly record of failures of all kinds, and a spell of unusually severe winter weather is immediately marked by a sudden increase in the number of failures, one most potent reason being the rigidity and unevenness of the rail support. On the other hand, a succession of mild winters may show such a comparative immunity from failures as to delude us into the belief that at last we are making definite progress.

The number of rails which fail annually, as compared with the total number in service, is very small when reduced to percentages. In many materials it could be ignored as purely an economic loss, and not very large at that. The enormous preponderance of those laid are removed because they are worn out. It is because the rail is part of a chain that its occasional failure assumes such importance.

PROGRESS DISAPPOINTING

With the above points in mind, it must be said that the available data do not show that progress in performance which we have a right to expect. It is true that certain classes of failures have greatly diminished, but these are directly traceable to improvements in design rather than in quality, and, taking the records altogether, the progress is very disappointing.

That the real answer to this great problem has not been reached is proved by the continued unrest in our specifications, and by the everlasting changes in sections.

What answer can we make?

First, as users, we can and should lessen as far as possible unnecessary punishment of the rail by improvements in the mechanical design and maintenance of our equipment.

We can be expected to improve our structure under the rail as our loads increase, and this change is in progress. It is but fair to say that bad conditions, both as to equipment and track structure, have contributed to rail failures. It is probable that this condition has always existed, and in times of business depression maintenance standards may have been lowered, but, altogether, the conditions of use are not worse. It is not probable that perfect track will ever be constructed or maintained, as the means for doing this are necessarily too crude.

That the large number of failures of rails has attracted no more attention is because of the vigilance of the track inspection. In the very great majority of cases the rails are removed before any serious results ensue, but we must not take too much comfort from this fact, for each case offers the possibility of most serious consequences, and this is fully recognized.

Against these unsatisfactory conditions we have several possible solutions: Better steel, in the sense of more uniform steel; better steel in connection with more rational sections; materially heavier sections; or retrogression in loads and speeds.

To date, a combination of the first and second has been chosen. There has been a very general change to open-hearth steel, at an increased cost.

CHEMISTRY OF RAIL ITSELF NEEDED

Committees of this and sister societies have worked almost continuously on the subject of specifications. To-day, after our fourth revision in a period of eight years, our specification is almost identical with that of the American Railway Engineering Association, but the seemingly small differences are really very important. Both specifications are identical in chemical requirements; both provide that the chemistry furnished by the producer shall be that of the drillings from the ladle test ingot; but both ignore the fact that the chemistry of the actual rails, at least of part of them, is apt to differ widely from the ladle analysis. In the case of the open-hearth specifications there is at least the merit of an analysis for each heat. In the case of the Bessemer rail the chemistry other than carbon is averaged from two complete analyses per 24 hours, to determine the quality. It is difficult to see how a specification could be made more absurd, and yet this clause in one form or another has been and still is part of many specifications, and it did not originate with our committee.

Neither the American Society for Testing Materials nor the American Railway Engineering Association specification really protects the buyer as to chemistry. Neither puts any limit on the amount of segregation permitted, and it is well known that this ranges over wider limits than would be permitted in the ladle analysis.

In investigating the causes of the failures of individual rails many analyses have shown such startling discrepancies between the composition of the failed rail and the analysis purporting to represent the heat that it was difficult to believe that they could represent the same material. Either the ladle analysis is an unreliable index of the quality of the material in the rail, or there is a great need for chemical reform. We know by experience that when put to it, the chemists of the producers and the consumers can tally within very reasonable limits. This is a serious matter for the consumer. In one of the railroad wrecks due to a failed rail, the Government representatives analyzed the rail and discovered that the composition did not at all agree with that called for in the specification, and severely scored the road for not enforcing its own specifications. How far the difference between chemists is due to difference in methods I do not know, but possibly the methods by which the chemistry is determined may have to be agreed upon and made a part of our specifications. Dr. C. B. Dudley, who did much work on standardizing methods of chemical analysis, would in his specifications not only state the composition required, but also the methods by which the determination was to be made.

UNSATISFACTORY MATERIAL ACCEPTED

From the physical standpoint both specifications are defective, as both contain the provision that if the test piece meets the requirements the material will be accepted; but in the event of the failure of the first test piece, two more tests are made, and if both pass, the material is accepted. We hold that this is a pernicious practice, in that the consumer has positive proof that some of the accepted material does not meet the requirements. How this clause ever crept into the specifications, we do not know. We do know that it is nothing new. If meeting a single test means acceptance of a definite quantity of material, failure to do so should mean a definite rejection, and in a number of our other specifications this is the case.

"SPECIAL" RAILS

Our own American Society for Testing Materials specification includes all the machinery for detecting physically unsound material by nicking and breaking, and then provides that the rails represented by these unsound test pieces shall be accepted as "special" rails. Presumably they are to be used in some unimportant location. This is another very bad practice. It is not always possible to find unimportant places. Designating marks in the way of paint or punch marks become illegible in time. The only sure way to keep such material out of important service is not to ship it from the mill. The total additional cost per ton for eliminating both of these objectionable physical clauses is quite well known and is not large. In some specifications both are cut out, but we hold that a buyer should not have to pay an additional price to avoid taking material which does not fairly meet the prescribed tests.

Summed up, the rail specification of our Society does not put a proper premium on the selection of the better part of the ingot for one of the most exacting services for which steel is used. Where our specification differs from that of the American Railway Engineering Association it is not so good.

Our committee is composed of able men. Among them are some of the ablest metallurgists in the country, and we should look to them for that constructive work which would make our specification beyond criticism. The purpose of our Society is to make specifications and have them used. If year after year we retain provisions that lessen the incentive to improve the product, we cannot wonder if other specifications are preferred.

FEW IMPROVEMENTS IN METHODS

If we consider all the steps in our rail industry, we find very few improvements in methods other than those which lend themselves to increased output or reduced cost. There are some notable exceptions to this, three in particular: namely, the electric furnace, for producing better steel; the sinkhead process for casting ingots, for producing better ingots; and the deseaming process, for producing better rails, by mechanically removing some surface defects which would later develop into seams. All of these processes are represented by rails actually in track under observation, but it is yet too soon to justify an opinion as to their value, nor have any of these methods been generally adopted.

In this connection, it may be mentioned that, in addition to the sinkhead-process steel rail made in this country by American methods, we have, also, a small supply of ingots made in Sheffield by the Hadfield patented process, which will shortly be rolled into rail and put in service.

Heat treatment, although not yet on a commercial scale, has been attempted, and such rails are actually in service under severe conditions. So far as non-service tests go, the results are promising.

HOPE IN LARGE-SCALE EXPERIMENTS NOW IN PROGRESS

It is to be hoped that some of the large-scale experiments now in progress will show what is to be looked for from a more uniform product. One of these includes the requirement that the chemistry shall be from the rail, instead of from the ladle test ingot, and the segregation must be within reasonable limits. This experiment will, at least, give a quantity of fairly uniform material, so far as any practical method of representative testing will insure it. Let us hope that it will give some definite light as to how far we should go toward more uniform material.

Should it develop from the test of service that by means of more uniform steel, namely, by analysis from the finished rail, with limits of permissible segregation, we eliminate enough of our serious failures to make it worth while, we will have to face the question of how such provisions shall be carried out. It is certain that few railroad organizations have the chemists to make the determinations on the spot, so that by the time the rail is ready for shipment the makers will have advice from the chemists that the steel is acceptable. It is very desirable that this complication be avoided, but, if uniform steel proves to be the remedy, the consumers must know that they are getting it.

Aside from these, and some experiments on too small a scale to deserve special notice, the rail situation remains very much as it was seven or eight years ago. Any deviation from the beaten path is immediately met by an increase in the price asked, the reasonableness of which the purchaser has no means of determining. In at least one case of which I have knowledge, the actual expense of every kind, so far as it could be ascertained, due to rail breakage on a certain system was less than one-fifth of the annual increase in the cost of rail due to the introduction of a proposed new specification designed to secure the quality of rail desired. The year taken was not an abnormal one in any way. One serious wreck would, however, entirely have changed this showing. It requires a lot of courage and a strong sense of duty to justify such an expenditure when the direct return is problematical.

Heavier Rail

There are many who believe that we cannot hope for relief by the use of more uniform steel. They make the point that, if this is the solution, it can be obtained by a discard larger than the ordinary. They cite the records of the carriers to show that the failures, especially the breakages, are fairly well distributed throughout the ingot, so that no practicable discard would eliminate the trouble. They also call attention to the many examinations of broken rail which reveal no defect that we can recognize as such. From these conditions they argue that the only remedy is to use more steel—that is, heavier sections—without any change in the specifications as to quality. Possibly this is correct, but we would call attention to the fact that post-mortems on rail sometimes give negative results, because we have not before us all the related evidence. The rail may have been damaged by unfair usage, of which there is no evidence. If due to defective support, the evidence is lost when the track is repaired. Damage from defective wheels, etc., leaves no permanent mark. There is a growing belief that the straightening press, by straining the material beyond the elastic limit, is responsible for many otherwise unexplainable failures, and it would also explain why rails from the lower part of the ingot figure so prominently in the breakage record.

As to the quality, we cannot ignore the fact of the difference between rails from different mills. There have been some notoriously bad rollings, as shown by the records of various roads, and these mills have subsequently turned out an excellent product. If all of the rail was as good as the best, we would have very little room for complaint.

The present line of progress includes a general increase in the weight of sections throughout the country. The 100-lb. mark, or that neighborhood, seems to be one of the halting spots, but some sections go considerably beyond this figure. A careful study has been made of the sections, and the new ones, especially of the heavier weights, are believed to be better adapted to secure good mill results, as well as better performance in the track.

Personally, I believe that the time has arrived for a considerable increase in the weight of sections, and I am not so certain that a change of quality is required at the same time. One reason that appeals is the presence within recent years of that class of failures known as "transverse fissures." So far, there seems to be no satisfactory explanation. It seems surprising, if this class of breakage develops in the rail, that it should not also do so in the tire, which is subject to the same intensity of pressure. The tire, however, has an immensely greater section than the head of the rail, and it is not until from one-third to one-half of the original area has been removed by wear and turning that it becomes necessary to remove the tire from service. If the mere fact of the relatively large area or section of the tire contributes immunity from this class of failure, it is fair to assume that somewhat the same result could be looked for in the case of the rail head.

Certain practices, such as the present system of straightening, have long called for improvement. Nearly all rail passes through the gagging press. The rail specifications are possibly too exacting in requiring that all rails shall be "smooth, straight in line and surface, and without any twists, waves, or kinks." It is a question whether this is not asking too much for the good of the rail and whether it would not be well to make the greatest possible tolerance in the way of accepting rail with such variations from straightness as can be reasonably eliminated in laying.

Mill Methods

In the search for a remedy for our troubles, some have proposed to improve the product by more or less radical changes in the mill practice. It must be remembered, however, that a modern steel mill, like the railroad, can only exist by being operated on a large scale. It is designed in advance with a view to a certain sequence of operations, and if proper provision has been made for each, smooth operation follows. The mill, however, is only balanced when it performs these operations in the prearranged order, and to make a radical change—as, for instance, slow rolling, cold rolling, more passes, or one of the many other innovations suggested, may seriously unbalance the whole operation. It is not to be expected that a mill will be willing to make changes in its practice until after experimental work has demonstrated that the proposed practice is practicable and valuable. This does not mean that the mere assertion that the proposed changes are impracticable absolves us from doing anything further; on the contrary, the steel mills should be willing to go as far as possible in the direction of proving or disproving these theories.

Many of the questions could be settled by a small mill, in connection with a large one, at which experiments could be made without affecting the regular operations of the works. It may be feasible to provide such a mill by some form of co-operation, through which the expenses and the benefits may be distributed among subscribing companies.

In conclusion, I must repeat that the rail situation, as we see it, is disappointing. To add to the complexity of the situation, the Government, through some of its bureaus, is taking a hand and investigating every serious failure, apportioning blame and suggesting remedies. This will probably increase rather than diminish, and may some day be very awkward for the producer as well as for the user.

The function of our society is to prescribe specifications and tests, which, if enforced, will prevent improper material from getting into service. This calls for constructive work in committee; but it has been accomplished with other products—why not with rail?

Merits of Philadelphia Pavement Explained by Placards

IN CONNECTION with the completion of the granite-block pavement laid in Germantown Avenue, Philadelphia, the engineer in charge, William H. Connell, chief of the Bureau of Highways and Street Cleaning, has taken steps to call the attention of the public to the pavement as a desirable one for a business street. A number of attractive frames have been erected at important corners along the avenue, and behind a glass front is a large poster card headed as follows:

> Improved Type of
>
> GRANITE BLOCK PAVEMENT
>
> On Six-Inch Concrete Base
>
> Germantown Avenue
>
> The construction of this pavement presents:
>
> The latest and best practice in granite-block pavement work.
>
> A type designed to withstand the extremely heavy traffic on this street.
>
> A surface which will be smooth riding for automobiles and will afford a good foothold for horses drawing heavy loads.
>
> Foundation Course:
>
> The pavement is laid on a six- (6) inch concrete base mixed in the proportions of one part Portland cement, three parts sand and six parts stone.
>
> Cushion Course:
>
> Between the concrete foundation and the block surface there is a one-inch sand cushion.
>
> Surface Course:
>
> The improved granite blocks are from eight to twelve inches long, three and one-half to four and one-half inches wide, and from five to five and one-half inches deep, accurately dressed. The heads are so cut that they have no more than three-eighths of an inch depression from a straight edge laid in any direction across the head and held parallel to the general surface of the block. The joints are not more than one-half inch wide at the top and for a depth of one inch, and not more than one inch wide in any other part of the joint. They are filled with a grout of Portland cement and sand in the proportion of one part of cement to one part of sand.
>
> For further information, apply to
>
> Chief Bureau of Highways and Street Cleaning
> Room 232, City Hall Philadelphia

More than $3,000,000 will be spent for public works this year in British Columbia, it is announced. Of this sum $2,500,000 is for improving existing highways and for maintenance of existing bridges and roads. About $600,000 will be spent in extending and preparing for the construction of public buildings in the Province.

WEST SIDE OF NEW STRUCTURE ON APRIL 16—OCEAN IS ON THE RIGHT

Note the three wings, each extending farther from the main building than the preceding in order to give a maximum number of rooms with ocean view.

Largest Fireproof Resort Hotel in the World Completed at Atlantic City

Hotel Traymore Adds Eighteen-Story Reinforced-Concrete Structure Containing Large Domes, Cantilever Beams and Many Offset Columns

THE NEW Hotel Traymore at Atlantic City, N. J., which was opened for guests on June 1, consists of the addition of an eighteen-story structure to the older twelve-story reinforced-concrete building, finished about five years ago, which was altered to insure structural unity of the two buildings. The new structure is 238 ft. high from grade to top of the new large domes, and in addition to being the largest resort hotel in the world, is also the highest reinforced-concrete structure, with one exception—the tower on the recently completed Robert Gair warehouse in Brooklyn, which is 258 ft. above the sidewalk, and nearly 100 ft. above the main twelve-story building. The new hotel building is marked by several special features and by an unusual variety in the types of construction used. Among the features which will be described in some detail the more important are the tests of piles in sand foundations, the several types of floors and columns used, the many offset columns, the construction of heavy reinforced-concrete cantilever girders, and the large domes and connecting gallery at the roof.

The new complete structure covers an area 140 x 520 ft. Above the fourth floor, which is the first sleeping floor, the main building is about 54 ft. wide, and three wings are carried successively two, three and four bays out from the main building in order to insure a maximum number of rooms with an ocean view. One of the accompanying photographs shows the general appearance of the new structure on April 16. Above the eleventh floor the building reduces in plan at each floor until it is finally capped off with the two large central domes and a smaller dome over the fire tower. This reduction in plan resulted in many offset columns requiring heavy supporting girders, and the domes and galleries further added to the complication in form work. In spite of the difficulties of construction, however, the building was erected in record time, only nine months being required to complete the new work.

As an indication of the number of offsets and resulting structural problems it can be stated that in addition to the 179 columns resting upon the foundations there are 132 columns starting from girders on the various floors. Of the forty-one columns at the springing lines of the domes only nine continue down to their own foundations, the other thirty-two being supported by girders at various floors. One of the photographs shows many offset columns above the twelfth floor.

SPECIAL FOUNDATIONS ON SAND

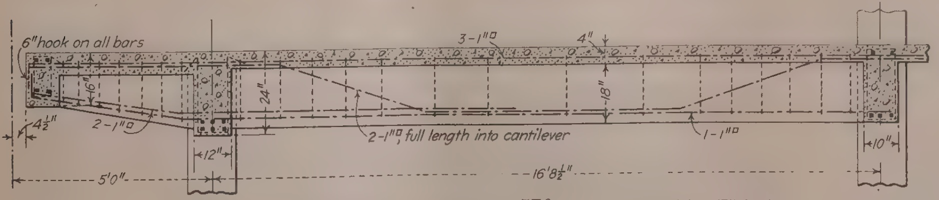
The foundations on sand were constructed of reinforced-concrete mattresses on timber piles. The piles averaged 18 ft. long and were jetted into place, then tapped with a steam hammer to practical refusal. In designing these foundations it was necessary to take into consideration the variable heights. During erection some piles were fully loaded far in advance of adjacent piles; in fact, there were times when piles in one cluster had five times the load of those in an adjacent cluster. Therefore, to overcome the tendency to unequal settlement, the rather low unit load of 15 tons per pile was used, considerably less than that adopted in the original building, which was not subjected to this condition.

The results of a series of tests on piles in the sands of an adjacent plot were secured to aid in determining the allowable load per pile. It was found by these tests that a long 32-ft. pile was little more effective than a short pile about 16 ft. long, and also that a pile by itself developed a greater unit resistance than piles arranged in a cluster about 2 ft. 6 in. center to center. The basement walls were reinforced to resist water pressure, assuming a slight reduction on account of the retardation due to seepage through sand. Where retaining walls and secondary tanks rest directly on the sand, 2 tons per square foot was allowed.

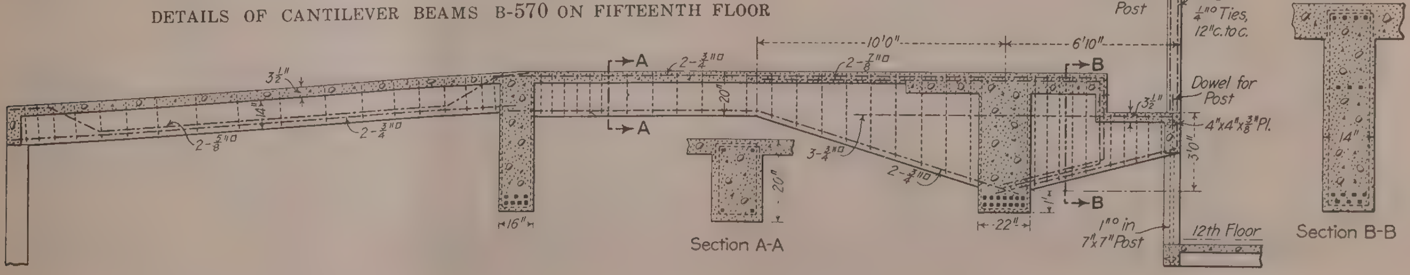
LIVE LOADS AND DESIGN STRESSES

The design was made to conform to the Atlantic City building laws, and the usual allowable unit stresses were used. In a few special cases, where beams supported offset columns with live load from several floors, the unit stress in steel was increased to 20,000 lb. The live loads per square foot were: Roof, 30 lb.; sleeping floors, 60 lb.; laundry floors, 150 lb, and special machinery concentration; kitchen and main exchange floor, 100 lb.; garden and slab construction, 200 lb. The live load on the girders was reduced 10 per cent when 100 sq. ft. or more of live load was carried, and 2 per cent additional for each additional 100 sq. ft. The live load on the columns was reduced to 5 per cent per floor (except for roof, top floor and exchange floor) until 50 per cent was reached, when such reduced load was used throughout the remaining floors.

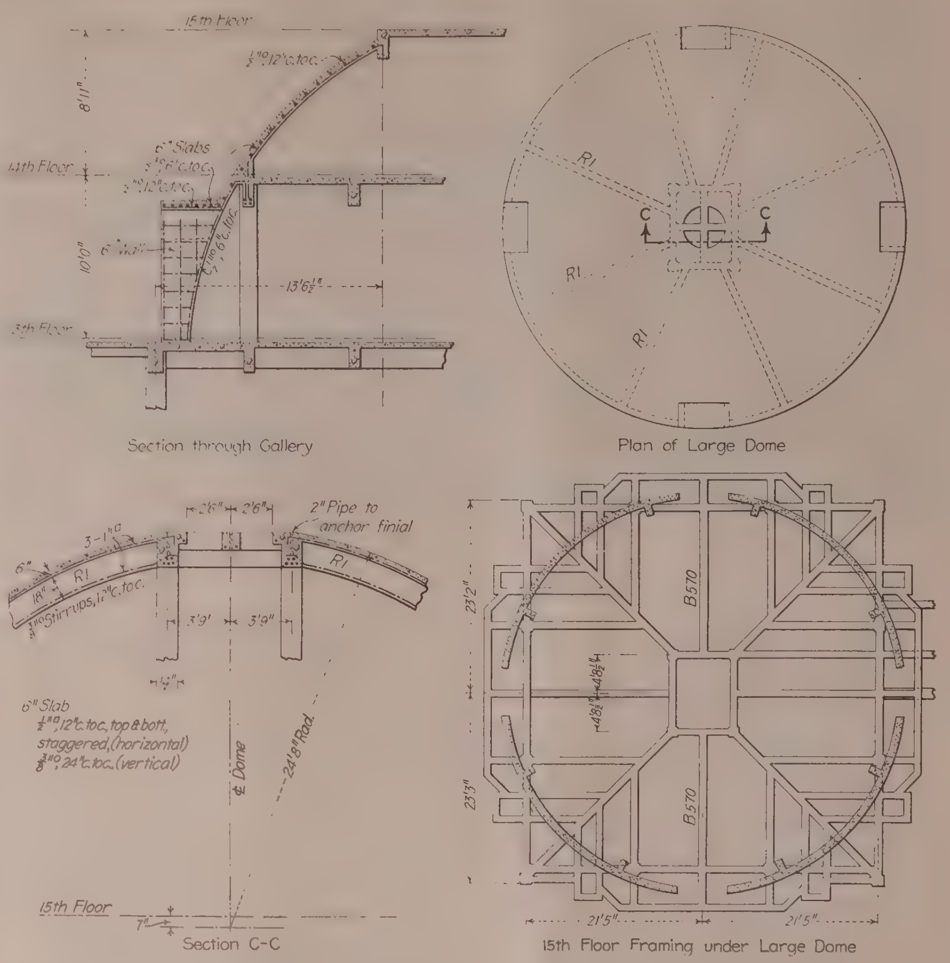
The mushroom-slab floor with four-way reinforcement was designed for a moment of *WL*/ 24 at the center of diagonal bands



DETAILS OF CANTILEVER BEAMS B-570 ON FIFTEENTH FLOOR



CROSS-SECTIONS OF 44-FOOT GIRDERS, AND ELEVATION OF CANTILEVER BEAM AT ROOF OF TWELFTH FLOOR



Section through Gallery

Plan of Large Dome

Section C-C

15th Floor Framing under Large Dome

SECTIONS OF GALLERY AND DOME, AND PART PLAN OF FIFTEENTH FLOOR

and *WL*/12 at the center of the straight bands. All rods were carried to the quarter points of the adjacent panel, which doubled the reinforcing steel over the columns where the rods were bent up to within 1 in. of the top of the slab. The column caps were made one-fourth of the span in diameter and designed for the bending produced by unequal loading. Three types of columns were used—square or rectangular concrete columns at 500 lb. per square inch, reinforced with 1½ per cent of vertical rods tied with ¼-in. rounds 12 in. on centers; hooped columns of 1000 lb. per square inch on the concrete inside the hooping, with vertical rods and hooping designed by the Considère formula; and structural steel cores at about 15,000 lb. per square inch with fireproofing concrete casing counted only as increasing the radius of gyration of the column.

The domes were designed for true dome action, the horizontal reinforcing bands completely around the domes being assumed to resist the thrust from the part of the dome above the ring designed. Ribs were used as arched beams on the interior of the shell. Where openings were cut in the domes secondary members were incorporated above and below to take up the stress.

FLOOR AND COLUMN DETAILS

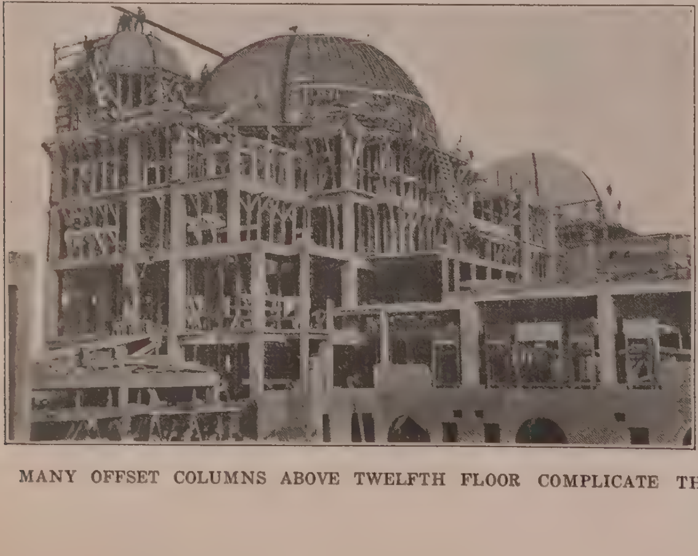
The main exchange floor is of the mushroom-slab type and forms the ceiling of the grill room in the basement. In the center intersecting reinforced-concrete beams support the glass bottom of a pool to enable the guests of the grill room to see the fish in the pond in the ceiling. Around the pond is an earth garden which this mushroom system supports. The mezzanine and first floor are mainly long-span tile-and-concrete slabs on reinforced-concrete beams forming panels which conform to the architectural features. A number of columns are offset on this first floor, and steel beams fireproofed with stone concrete are used for their support. On the central wing of the second floor large steel girders were used to support the columns coming upon them from the thirteenth floor, thus eliminating central columns from the dining room. Above the second floor typical reinforced-concrete beam-and-slab construction is used.

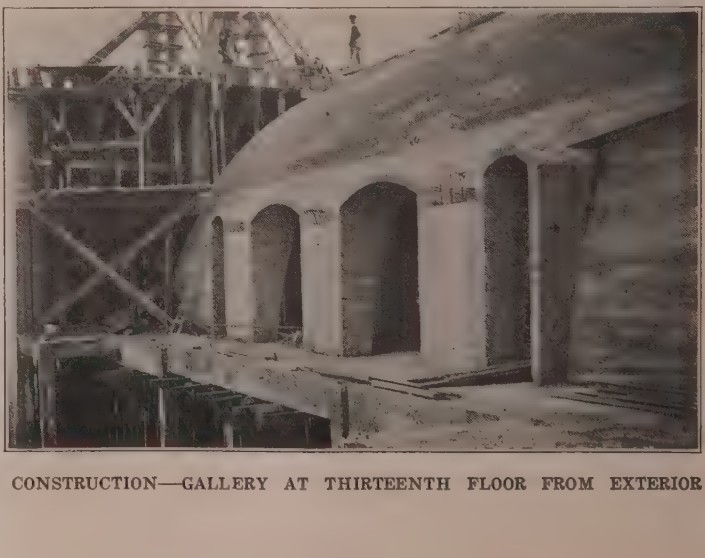
All offset reinforced-concrete columns were doweled to their supporting girders by the use of four ¾-in. round dowel rods 3 ft. long extending 18 in. into the columns. When steel girders were used these dowels were placed in punched holes in the top flanges, and where reinforced-concrete beams were used they were properly set before pouring the beams. From the eleventh floor up the reduction in size of building results in many of these offset columns, as seen in one of the photographs. The fourteenth and fifteenth floors contain many cantilever beams supporting the large brick buttresses extending 35 ft. below the dome and projecting outward a maximum distance of 13 ft. from the columns.

Bay windows of both slab-and-beam type and balconies supported on reinforced-concrete brackets were used at various floors, as can be seen in the view below the heavy cantilever girders at the roof of the twelfth floor. A balcony was added to the old building and supported on steel brackets stone bolted into the existing reinforced-concrete columns. A test load of 120 lb. per square foot, or twice the live load, was applied to this balcony without measurable deflection, proving the value of stone bolts when properly used. One of the detail drawings shows a typical reinforced-concrete column bracket to support steel beams at the twelfth floor. When steel columns were used bracket angles were furnished to support the reinforced-concrete beams which were poured with the concrete casing of the columns.

SPECIAL CANTILEVER GIRDERS

Unusually heavy reinforced-concrete girders of 44-ft. span in the roof above the twelfth floor are shown in the illustrations, the special cantilever beams supported by them being shown in elevation on page 11. These cantilever beams support at their overhanging ends the adjacent thir-





MANY OFFSET COLUMNS ABOVE TWELFTH FLOOR COMPLICATE THE CONSTRUCTION—GALLERY AT THIRTEENTH FLOOR FROM EXTERIOR

HEAVY GIRDERS AND CANTILEVER BEAMS

Adjacent portions of twelfth and thirteenth floors are supported below and above left hand ends of cantilevers.

teenth-floor loads on reinforced-concrete columns and the twelfth-floor loads by steel hangers and anchor plates. The steel reinforcing in these cantilever beams and the heavy supporting girders should be noted, especially the manner of bending the rods in the cantilever ends.

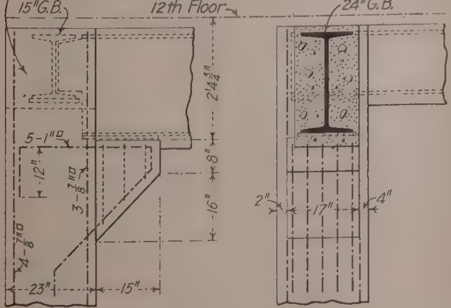
The usual type of reinforcing used in the many cantilever beams in this building is indicated by the detail drawing, page 11, of one of these beams in the fifteenth floor. At this floor many cantilever beams are necessary. The ample provision for shear stress, the bent rods for negative bending moments and the typical cross-sections of the supporting reinforced-concrete beams are all shown on the drawing.

MAIN DOMES AND GALLERIES

The two main central domes are about 48 ft. in diameter and are constructed of spherical reinforced-concrete slabs with eight arched ribs as shown in the accompanying section and plan. Horizontal circular rods ½-in. square on 12-in. centers staggered top and bottom are used in the 6-in. domes, to take the thrust as already explained. The central columns were introduced after the first design was completed. Part of the fifteenth-floor framing plan shows the complicated nature of form work required for the beams of this floor, and the supports for one dome. Each dome weighs 240 tons, two-thirds of which is carried by concrete girders or beams as shown.

A cross-section of the connecting gallery at the thirteenth floor is also shown, and a photograph of the exterior portion with a view of the dormer windows for which the reinforcement is given on the drawing.

Considering the great variety of problems involved, it is probable that the structure as a whole is one of the most complex ever constructed of reinforced concrete. The architects were Price & McLanahan, the structural features were designed by Otto H. Gentner, Jr., and F. Dickinson Shaw, and the contractors were Cramp & Company, all of Philadelphia.



COLUMN BRACKET FOR STEEL BEAMS

Waterworks Analysis Contains Data from 5185 Towns

THE STATISTICAL summary of American and Canadian waterworks plants, contained in the accompanying table, is from the recently published *McGraw Waterworks Directory*. It presents in condensed form records from 5185 towns, of which 3301 are municipally owned and 1403 privately owned. In addition to the analysis of ownership there are columns showing the use of pumping equipment other than steam. Of the towns listed 517 employ electric equipment and 343 are dependent on water power. An interesting feature of the analysis is the evidence of the extent to which light and waterworks plants are combined. In 1044 towns, or roughly 20 per cent of the total, this consolidation of the two principal utilities is in effect. The figures in the column "Plants Using Water Power" have been revised since the first edition of the directory appeared.

STATISTICAL SUMMARY OF AMERICAN WATERWORKS

State, territory or province	Number of towns listed	Municipally owned	Privately owned	Mixed ownership	Supplied from other towns	Combined light and waterworks	Using electrical equipment	Plants using water-power
United States								
Alabama	71	47	16	1	7	22	11	2
Alaska	7	..	7	..	..	3	..	..
Arizona	26	7	16	..	3	1	10	..
Arkansas	61	27	31	..	3	17	12	1
California	250	81	136	11	22	17	109	..
Colorado	90	74	13	..	3	4	7	1
Connecticut	127	18	62	5	42	2	11	3
Delaware	11	7	4	..	..	4	7	..
Dist. of Columbia	1	1	..	..	..	..	..	..
Florida	48	31	16	..	1	38	27	..
Georgia	116	110	6	..	..	..	1	4
Hawaii	1	1	..	..	..	..	..	..
Idaho	49	23	25	..	1	6	20	1
Illinois	312	247	53	1	11	12	70	..
Indiana	146	90	54	..	2	40	29	..
Iowa	248	228	20	..	..	4	75	2
Kansas	170	154	15	..	1	20	49	1
Kentucky	53	22	31	..	..	4	8	1
Louisiana	35	29	6	..	..	13	5	..
Maine	103	17	65	1	20	4	7	3
Maryland	48	23	25	..	..	3	3	..
Massachusetts	209	145	51	1	12	..	27	3
Minnesota	182	175	7	..	..	32	36	4
Michigan	118	95	19	..	4	9	33	11
Mississippi	66	59	7	..	..	17	15	..
Missouri	82	55	27	..	..	23	37	1
Montana	33	18	14	..	1	6	8	1
Nebraska	98	95	1	..	2	8	26	..
Nevada	29	11	14	..	4	4	3	3
New Hampshire	43	26	17	..	..	..	4	2
New Jersey	261	71	90	5	95	8	30	6
New Mexico	15	6	8	..	1	3	3	..
New York	273	167	73	7	26	8	48	4
No. Carolina	66	57	8	..	1	9	28	..
No. Dakota	27	24	3	..	..	3	3	..
Ohio	196	156	34	..	6	12	24	3
Oklahoma	94	87	6	..	1	30	30	..
Oregon	55	35	19	..	1	8	11	2
Pennsylvania	418	92	176	3	147	4	27	8
Porto Rico	7	7	..	..	..	1	..	..
Philippine Islands	3	1	2	..	..	..	..	..
Rhode Island	14	3	7	1	3	..	..	1
So. Carolina	32	22	9	..	1	6	16	2
So. Dakota	48	45	3	..	..	1	6	..
Tennessee	49	35	14	..	..	22	9	..
Texas	147	75	67	..	5	29	32	2
Utah	21	18	3	..	..	..	1	..
Vermont	53	35	18	..	..	3	4	2
Virginia	45	25	14	..	6	4	9	1
Washington	48	45	3	..	..	1	8	3
West Virginia	45	21	22	..	2	8	8	..
Wisconsin	101	83	17	1	..	20	19	2
Wyoming	21	19	1	..	1	..	3	..
Totals for United States	4,872	3,045	1,355	37	435	493	969	80
Canada								
Alberta	18	16	2	..	..	2	4	..
British Columbia	27	19	8	..	..	4	3	..
Manitoba	11	9	2	..	..	..	4	..
New Brunswick	17	15	1	..	1	..	2	..
Nova Scotia	31	27	3	..	1	2	3	1
Ontario	129	114	13	2	..	13	41	17
Prince Edward Island	2	2	..	..	..	..	..	..
Quebec	62	38	19	2	3	3	14	8
Saskatchewan	15	15	..	..	..	..	4	..
Newfoundland								
Newfoundland	1	1	..	..	..	..	..	..
Totals for Canada and Newfoundland	313	256	48	4	5	24	75	26
Grand totals	5,185	3,301	1,403	41	440	517	1,044	106

THE PNEUMATIC METHOD OF PLACING CONCRETE was used successfully for conveying the mix 2805 ft. through a 6-in. pipe on the Mile Rock tunnel work at San Francisco. The compressor capacity installed was 1200 cu. ft. per minute and the receiver pressure was kept at about 115 lb. per square inch. This is regarded as a record for long-distance work of this character.

Committee on Concrete Tests Outlines Work in Progress

Many Series of Tests Have Been Distributed to College and Commercial Laboratories by American Society for Testing Materials

IN ITS REPORT presented to the American Society for Testing Materials at the annual meeting in Atlantic City, N. J., June 22-26, committee C-9, on standard tests of concrete and concrete aggregates, outlines the procedure which is being followed in most of its investigations. The practice is to distribute series of tests to various commercial and college laboratories, with very complete instructions. These tests are arranged so that each series is duplicated several times, and are designed to separate the individual variables in order to determine, one by one, the specifications for each function. The committee's report was received and ordered printed.

CO-OPERATIVE INVESTIGATION

The committee has been fortunate in having for preliminary use the results of the investigations carried on by the committee on specifications and methods of tests for concrete materials, of the American Concrete Institute, published in their *Journal* for October and November, 1914. At the first meeting of the committee it was voted that the work of these two committees be co-ordinated and that they act as a combined committee in making the researches and tests.

The work of committee C-9 has been divided among nine sub-committees. Sub-committee 1 is in charge of the finances of the work. An outline of the work of the others follows:

Sub-Committee 2 *on Laboratory Tests for Concrete and Laws of Mechanical Mixtures.*—This sub-committee has outlined certain tests on concrete and mortars with the view of establishing the best practice in making and testing concrete specimens in the laboratory, and to determine the effect of variations in the gradation of sizes of the aggregates on the strength and properties of the concrete.

LABORATORY TESTS OUTLINED

The following series of tests have been outlined as a part of the necessary investigations:

1. Comparison of metal and wood forms for standard laboratory tests of concrete.
2. Variations in strength and properties of concrete throughout the batch.
3. Effect of different methods of tamping and compacting.
4. Effect of condition of storage of specimens for standard compression test of concrete.
5. Method of capping test specimens preparatory to testing.
6. Effect of gradation of sand.
7. Effect of varying ratio of fine to coarse aggregates.
8. Effect of varying sizes of fine to coarse aggregates.
9. Strength of mortar as affected by the form of the test specimens.

Sub-Committee 3 *on Sampling and Testing Field Concrete.*—In laying out the work for this sub-committee it was found that on a number of the larger concrete jobs field tests are being made, but there seems to be no uniformity of practice in making, storing, and testing the specimens. It was deemed wise, therefore, that this sub-committee select tentatively a method which seems to have the most merit, and recommend that wherever possible such tests be made.

FIELD TESTS

The following tests have been outlined:

1. Comparison of four methods of storage during first two days after molding.
2. Comparison of methods of storage subsequent to first two days.
3. Study of the cold-weather effect on field specimens.
4. Comparison of prisms made in the field and in the laboratory with prisms cut from work.
5. It is considered within the realm of possibility that a portable core drill can be made to use in cutting test specimens from concrete already in place in the form of 6 by 12 or 8 by 16-in. cylinders.

Sub-Committee 4 *on Relative Values of Various Strength Tests.*—In the field to be covered by this sub-committee there are certain fundamental problems which it is felt should be investigated as soon as possible. These may be stated as follows:

1. To establish the relative reliability of mortar strength tests for determining the suitability of sand for use in concrete.
2. A determination of the most desirable size and shape of mortar test specimens and the relation of tension to compression.
3. A determination of the most desirable size and shape of concrete test specimens.

Sub-Committee 5 *on Impurities Affecting Fine Aggregates.*—The work of this sub-committee is as follows:

1. In securing samples of fine aggregates which have shown abnormal results when used for concrete.
2. To make tests on the samples secured with the view of determining the cause of the peculiar action noted.
3. To find, if possible, an economical corrective for such peculiarities.

SAMPLES OBTAINED

In order to secure samples for this investigation, letters were addressed to a large number of persons throughout the United States and Canada, who it was thought might be able to assist in supplying samples of sand which would be of economic importance if the impurities could be removed. Considerable information has been collected concerning sands of this kind. Several samples have been received and are now being subjected to preliminary tests. The tensile and compressive strengths of mortars made from each of these sands will be compared with mortar from standard Ottawa sands, using various brands of Portland cement. Chemical analyses will be conducted on the foreign material in the sands, and an effort made to discover some method of treatment which will remove the defects. In searching for a corrective, the commercial aspect of the problem will be kept constantly in mind so that the method of correcting used for each sand will be practical and the most economical one available.

Owing to the extremely technical nature of the tests involved in this investigation, a chemist has been employed by the committee to carry out the chemical work under the direct supervision of one of the members of this sub-committee.

Sub-Committee 6 *on Methods of Tests for Voids, Weights, Density, Specific Gravity and Consistency.*—In the standardization of certain of these tests the committee is co-operating with other committees of the society in order to arrive at specifications which will apply to all classes of work. The first series of tests laid out has been with reference to methods of determining weights and voids.

VARIABLES TO BE STANDARDIZED

The variables to be standardized are (*a*) size of measure; (*b*) method of filling; (*c*) condition of sand.

(*a*) Four sizes of measures are being tried of the following capacities: 100 cu. cm., 1000 cu. cm., ¼ cu. ft., and 1 cu. ft., in order to find out whether it is necessary to make weight determinations on a large sample, such as ¼ cu. ft. or more. If smaller measures, such as 100 cu. cm., or 1000 cu. cm., give equally concordant results, they will be more easily used in the laboratory. The two larger sizes of measures are being tried in cylindrical and cubical shapes.

(*b*) Seven more or less different methods of filling the measures are being tried out. Each method as outlined has been in use by laboratories testing sand and each gives results differing more or less from the others.

(*c*) Two sets of determinations on condition of sand are being made; one with the sand dried at room temperature, the other with damp sand. Samples of two kinds of sand have been furnished by the committee to those performing these tests.

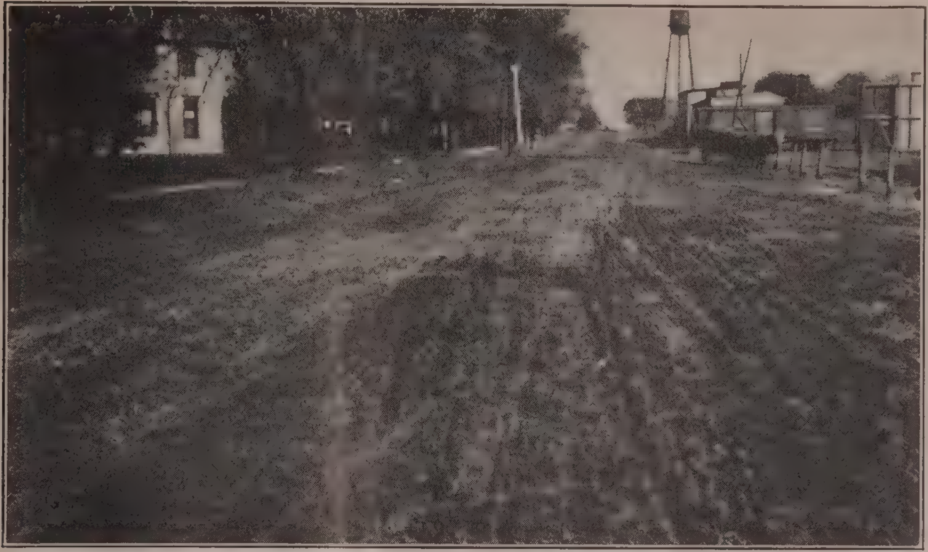
Sub-Committee 7 *on Methods of Tests of Coarse Aggregates.*—The work of this sub-committee is the investigation of methods of tests to determine the suitability of coarse aggregates for concrete to be used under varying conditions.

Sub-Committee 8 *on Available Aggregates for Concrete.*—The work of this sub-committee is the compilation of localities throughout the United States where concrete aggregates are available. The co-operation of geologists of the United States government in the various States will be solicited and also the assistance of engineers. The efforts of the committee will first be devoted to States in which there are few deposits of available aggregates.

Sub-Committee 9 *on Definitions.*—The work of this sub-committee is as follows:

1. To collect as many of the definitions as it can secure which are pertinent to the work of committee C-9.
2. To endeavor to secure the co-operation of all committees pertaining to concrete or correlated subjects of the various engineering societies in this country, with a view toward standardizing definitions pertaining to the testing of concrete and concrete aggregates.

GROSS OPERATING REVENUES FOR APRIL on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1010 per mile, showing a decrease of $28 or 2.7 per cent as compared with 1914. Operating expenses were $722, a decrease of $60 or 7.7 per cent. Net operating revenues, therefore, were $288—an increase of $32 or 12.3 per cent, and operating income was $239—an increase of $33 or 16.2 per cent. The operating ratio was 71.5 per cent, as compared with 75.3 per cent in April, 1914. Considering the three main districts, the respective ratios for April, 1915, and April, 1914, were as follows: Eastern district, 71.0 and 76.4; Southern, 70.9 and 75.2; Western, 72.3 and 74.2.



UNOILED SECTION IN FOREGROUND IS MUDDY; OILED PORTION BEYOND IS FIRM AND HARD

Iowa Experiments with Oil on Dirt Roads

Benefits, Limitations and Costs Applicable to Rural Communities Given by Engineers of State Highway Commission

OILING dirt roads in Iowa is practised as a cheap way to eliminate mud and dust. Pictures of oiled and plain roads in Ames after a protracted rainy period shown in the *Service Bulletin* of the State Highway Commission, from which the following notes are taken, indicate that oiling is well worth while. However, the following warning is given:

"Any town or community that places its faith in an oiled earth road as a substitute for a strictly hard surface road is doomed to disappointment. No combination of oil and ordinary Iowa earth has yet been found which will serve as a substitute for gravel, concrete, wood blocks, or brick. No such combination can approach the road crusts commonly known as sheet asphalt and asphaltic concrete. The oiled road will not stand up under hard or heavy traffic for a very long period in dry weather. It will not stand up under prolonged wet seasons if subjected to severe usage. While the oiled road is not even a cheap substitute for the higher class of surfacing materials, it has an important field as a dust and mud preventive or palliative. Small towns with oiled streets can get out of the mud and dust except in extreme conditions and at slight expenditure compared with putting down pavements. The oiled earth road has its place just as much as the cheap automobile. It may not stand the wear and tear of the higher priced article, but like the automobile, it will give a very satisfactory service."

Elgin, a town of less than 1000 people, has been oiling its main business street for five successive years. The fact that it has continued the oiling from year to year is evidence that the people are satisfied with the results they obtain. De Witt, West Union, Estherville, Monona, Postville, Castalia, Ayrshire and many other towns of the State are now resorting to the same practice.

Ames made its first experiment with oil during 1914. The oil was applied about the middle of the summer on several sections of two or three blocks each in various parts of the town. Two or three of these sections were so located that they took a great share of a heavy Chautauqua travel. Shortly following this a long rainy period set in and these and all the other oiled sections, by reason of their good condition, took a great deal more than their ordinary share of the city traffic.

OIL'S FUNCTION TO PREVENT DUST

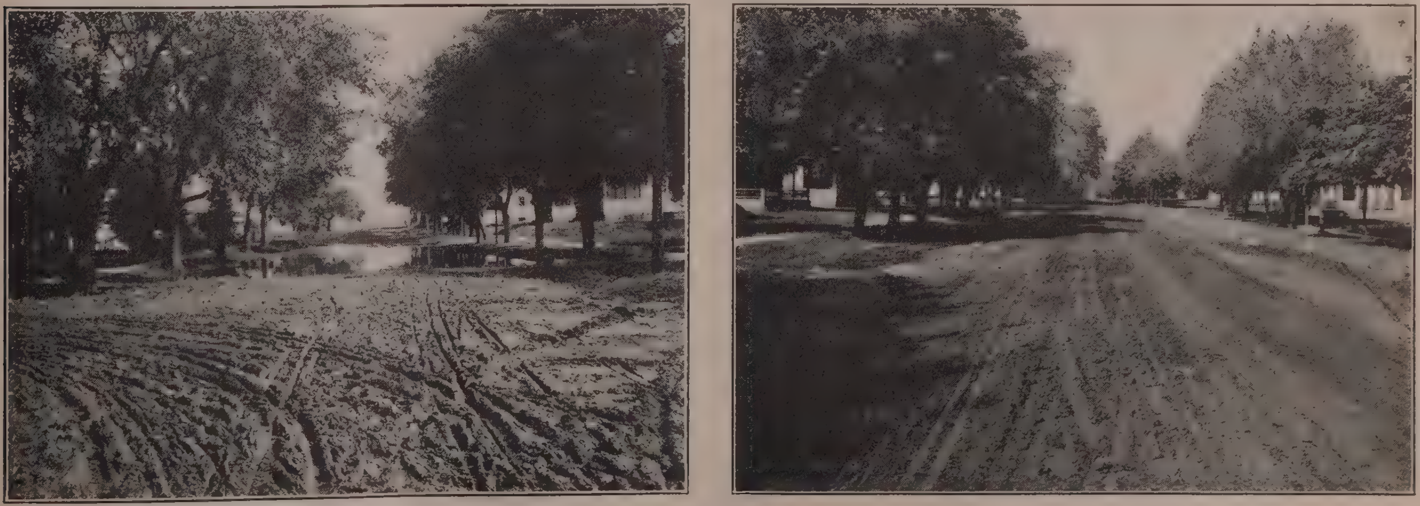
The chief value of oil on earth roads is as a dust and mud preventive. Its effectiveness in both cases depends upon two things, the character of the soil and the body and stickiness of the oil used. The oil has little or no resistance to wear. Its function is merely to hold the particles of earth together in a more or less solid and waterproof body. The moment the particles become torn apart either by horses' hoofs, or wheels of vehicles, there is dust in dry weather and mud in wet weather. In wet seasons the water-shedding character of the oil performs a valuable function in addition to waterproofing the road surface.

A very little sand will help out an oiled road surface greatly. Road-builders who have had experience with oiled roads urge that if possible a light coating of sand be thrown over the oiled surface as quickly as possible after putting on the oil. The oil, sand and dirt particles together greatly improve the surface over the straight oil and earth surface. The sand thrown over the freshly oiled surface prevents a large per cent of the oil being carried off the road by travel when the road is thrown open to traffic.

To the depth of penetration of the oil body which varies from 1 in. for a single application to 5 or 6 in. where the treatment has been continued for several applications spread over a series of years, depends in a large measure the success of the oiled surface as a waterproof road covering. The deeper the penetration of the oil the better the oiled surface will protect the earth below and the harder it will be to break up the road crust.

WHEN TO APPLY OIL

Oiling gives best results when used on thoroughly compacted grade, with perfectly smooth surface and as near the standard cross-section as it is possible to have it. Good results cannot be secured from a road surface that is freshly and loosely graded or that is full of pockets for water to stand in. It is a useless expenditure of money to oil a flat ungraded road and expect it to stand up at all under wet weather conditions. The oil should be put on after the grade has been properly shaped and side drainage amply provided for. The surface should be caught following a rainy



BECAUSE OF ITS BETTER CONDITION THE OILED STREET AT THE RIGHT CARRIED MORE THAN ITS SHARE OF TRAFFIC period, when it is thoroughly dried out but before it has begun to rut or before any appreciable quantity of dust has been formed. If there is any quantity of dust on the road it should be scraped off. Naturally the conditions in the late spring or early summer afford the best opportunity on the average for oiling.

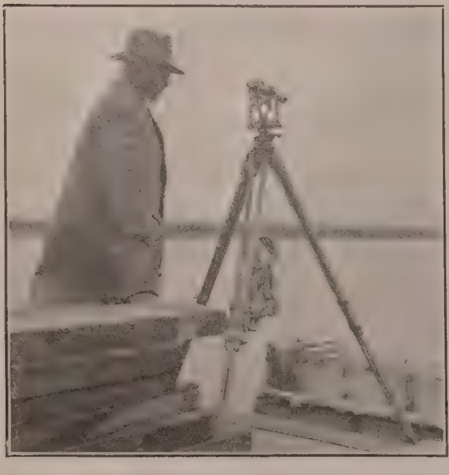
It is highly important to secure the best results that the oil should be applied hot. The best heat is approximately 180 deg. The heat can best be applied by steam, piped into the body of the oil tank. A convenient arrangement is to use a steam tractor to haul the tank and to draw the supply of steam from the tractor boiler. Far better penetration is secured by heating, the hot oil going deeper into the road surface and more perfectly permeating the surface than when applied cold, and there is less waste.

It requires about ½ gal. of oil per square yard per season to properly oil a dirt surface. The petroleum oils used cost about 4 cents per gallon delivered in the central part of the State. The cost of applying the oil will approximate on the average the cost of the oil. A 15-ft. roadway entering a town or in a country community would therefore cost $2 for each 60-ft. lot.

Chain "Anchorage" Holds Transit Steady in High Winds

IN the construction of the Yolo Causeway for the California Highway Commission near Stockton, Cal., it was found advisable to keep two transits on the job most of the time for spotting the concrete piles as they were placed for the driver. The causeway is in a location exposed to the winds and no shelter is available for the instrument men. As more than thirty concrete piles are often driven in 8 hours it is necessary for the transitmen to remain on the work in all kinds of weather, and they are often required to spot piles quickly in high winds.

Under these conditions it has been necessary to find some means for steadying or "anchoring" the transits, and this problem has been solved by simply taking short sections of the heavy chains used on the work, and substituting this weight for the plumb bob, as shown in the accompanying illustration, after the instrument has been set up at the desired point. The weight is suspended from a wire passing over the tripod head so that no injury is done to the plumb-bob hook.



TRANSIT HELD STEADY IN WIND BY CHAIN ANCHORAGE

New Methods of Odor Elimination at Garbage Plants Indicated by New York Tests

Irwin S. Osborn Finds That Furnace Heat Alone Is Not a Deodorizer of Insoluble Digester Gases—Final Washing Necessary

OFFENSIVE odors from New York City's garbage and dead animal disposal plants on Barren Island are to be eliminated by measures proposed by Irwin S. Osborn, of Toronto, and embodied in a report to the Board of Estimate and Apportionment which was commented on in the editorial columns of the Engineering Record of June 26. A number of changes in design and in operating methods are suggested and a radical departure from present practice is advocated for treating the insoluble gases from the digester tanks of the reduction plant. These gases, after passing through condensers, have been discharged into the boiler furnaces and passed thence to the stack. Mr. Osborn's investigations, which are claimed to be the most complete of their kind ever undertaken, show that this heat treatment, instead of acting as a deodorizer, actually makes the gases more offensive. It does, however, render them soluble so that the final process of treatment should be washing. Special attention also should be given, according to the report, to keeping all garbage digester tanks free from leaks and to the installation and operation of condensers with an adequate water supply.

THREE PLANTS AT BARREN ISLAND

There are three so-called disposal plants at Barren Island, all privately operated but under the general supervision of the Department of Street Cleaning. The largest is the garbage reduction plant of the New York Disposal Corporation. A fertilizer plant, where garbage tankage is dried, is operated by the Thomas F. White Company, and at a rendering plant dead animals are treated by the Products Manufacturing Company.

Garbage is delivered at the plant of the New York Disposal Corporation, the largest of its kind in the world, by scows, from which it is unloaded by grab buckets and discharged into scraper conveyors. Connecting the conveyors with digesters are swivel spouts which discharge the garbage directly into the digester tanks. The digesters are housed in two buildings, known as the New York building and the Brooklyn building. The New York digester building contains 68 digesters and the Brooklyn building 104 digesters. The digesters are approximately 6 ft. in diameter and 18 ft. long, constructed with a cone bottom, which is connected to a receiving tank by a large gate-valve and nozzle on the bottom of each digester. The garbage when cooked is discharged into the receiving tank, from which it is passed through a roller press, steam press, or hydraulic press, for extracting the free water and grease.

OPERATION OF DIGESTERS

The digesters when filled are sealed by tightly closing the charging hole at the top, after which live steam is admitted at the bottom. The steam, entering the bottom, circulates up through the mass submerging it at from 60 to 80 lb. pressure. After application of the steam from 6 to 10 hr., the garbage cells are broken down and material thoroughly sterilized and digested. The top of each digester has a 2-in. vent line for relieving the pressure on the digester after the material has been digested. The 2-in. vent line is closed off by a valve during the cooking period and the gases allowed to escape through a ⅜-in. by-pass. The digesters in the Brooklyn building are arranged similar to those in the New York building and vented in the same way through 6-in. main vent lines. The two 6-in. vent lines are carried to the end of the building, where they discharge into the digester vent tank.

Six-inch jet condensers are connected to the digester vent tank for condensing the steam and soluble gases. The discharge line from the condensers is connected to a blow-off tank, where the insoluble gases are trapped and the water overflows to the sewer. The blow-off tank is vented by means of a 4-in. line, which carries the insoluble gases and discharges them into the rear of the boiler furnaces, and thence with the combustion gases from the boilers to the chimney.

The garbage when cooked is discharged from the digesters into receiving tanks underneath, from which it is in turn passed through either roller, steam or hydraulic presses. Water and free grease are pressed out, flowing through a conduit to grease-separating catch basins. The solids are delivered by conveyors to the drying building, the whole operation being carried on in closed apparatus.

GASES FROM DRYERS

The solids from the presses carried to the dryer building are fed into the primary direct heat dryers, which consist of a large circular shell with furnace at the feed end. The material is fed into the dryer and as the dryer revolves the material cascades, coming in contact with the combustion gases from the dryer furnace, thus evaporating the moisture in the material. The dried material is discharged at the rear of the dryer into conveyors, which carry it to the percolating building. The vapors and gases coming from the dryers enter a large continuous chamber at the rear, which is connected to a flue leading to the chimney. The chimney, which is constructed of concrete, is 17 ft. in diameter and 225 ft. high, and not only takes care of the gases from the dryers, but also serves the majority of the boilers of the boiler plant. The dryer gases before entering the chimney are passed through a steel two-compartment scrubber, where the gases are passed through water spray to condense and take up the soluble gases. The scrubber was installed and placed in operation the latter part of 1914.

The dried material delivered to the percolating building is placed in extractors, and the grease left in the material extracted by means of a solvent. After treatment in the percolating building, it is carried by conveyors to the dryer building and passed through the secondary dryers, which are similar to the primary dryers, and the gases given off pass through a common flue to both sets of dryers, which in turn are connected to the scrubber. The dried material from the secondary dryers is taken by conveyors and industrial cars to tankage storage building, ready for shipment.

The boiler house contains ten 200-hp. and twelve 150-hp. horizontal tubular boilers, which are connected by a flue to the concrete stack. In addition to the above boilers there are four water-tube boilers of 380 hp. each and connected to separate steel chimneys. The water-tube boilers were installed in 1914. The total rated horsepower of boilers amounts to 5320 hp., the steam generated being used in cooking, pressing, percolating and operating steam engines and pumps.

REQUIREMENTS FOR ODORLESS PLANTS

The type of equipment installed in the plants on Barren Island is similar to that found in the majority of reduction plants. In few plants has the required attention been given to eliminate the undesirable features. Odors from rendering or reduction plants have been due largely to improper equipment and apparatus or to careless operation.

To eliminate odors the following essential features must be considered: 1. The type of equipment used should be such as to produce a minimum amount of gas-carrying odors. 2. The equipment and apparatus used should be designed and installed so as to confine all odorous gases. 3. Proper and sufficient means must be provided to deodorize the gases produced. 4. The equipment and apparatus installed must be operated properly and efficiently.

Proper attention from a sanitary or free-from-nuisance standpoint cannot be expected when sufficient control as to the manner in which the work is to be conducted is not obtained by the municipality. When contracts are awarded in competition for short terms it usually results in the plants being constructed with less attention being paid to details and permanent construction. It is an evident fact that when contracts are obtained it is necessary to charge off the larger part of the first cost of the plant during the life of the contract, and that the cost of operation will be increased when it is necessary to consider sanitation and freedom from nuisance as the first object. It is only natural to expect the commercial side to be foremost, unless proper control is exercised by the municipality, whether the work is conducted by contract or by the municipality.

THREE SOURCES OF NUISANCE

The odors given off by the garbage reduction plant, causing nuisance to the surrounding territory, come principally from three sources—the gases vented from the digesters, gases escaping from the apparatus, and the off gases from the dryers.

The gases carrying odors are treated at the reduction plant so as to eliminate a larger part of the odors, although they are not adequately or sufficiently treated. As previously described the gases vented from the digesters are passed through condensers where the steam is condensed and a large part of the gases are absorbed by the water. The insoluble gases are trapped in a hot well or vent tank and then vented through a pipe line to the boiler furnaces, so as to raise their temperature sufficiently to deodorize them. *From the tests made during this investigation it was demonstrated that by heating the gas to 2000 deg. Fahr. the odors were not eliminated but became more irritating as the temperature was increased, due to a change in the sulphur compounds to sulphur dioxide.*

INSOLUBLE GASES MUST BE WASHED AFTER HEATING

The practice of discharging the insoluble digester gases into the boiler furnaces has been universal in nearly all reduction plants. Mr. Osborn made tests in 1911 on deodorizing gases by heating to a high temperature, demonstrating that the gases could be completely deodorized. In conducting the tests water was used in producing suction on the test line leading to the high temperature furnace, so that after heating the gases were washed. The water was used only for siphoning the gases through the combustion chamber, the tests being made and a conclusion reached from the results obtained at various temperatures, while in reality, as demonstrated by the tests made during the Barren Island investigation, heating changes the sulphur compounds, producing a gas which becomes soluble in water.

The changes recommended call for abandonment of the present practice of discharging the insoluble gases into the boiler furnace, as, on being heated, they are given off with the odor caused by the chemical change.

The greatest source of the odors in the plant of the New York Disposal Corporation is the direct heat dryers used in drying the tankage. From determinations made approximately 175,000 cu. ft. of dryer gas per minute was given off. This gas, previous to the fall of 1914, was carried direct to the chimney and discharged to the atmosphere.

WASHING DRYER GASES

In 1914 the company installed a scrubber for washing the gases, so that the odors would be absorbed before entering the chimney. Tests were made which showed that the odors in the gases from the dryers were absorbed by water, but that the scrubber now installed was not as efficient as it should be, due to its design and the manner in which it was operated. The velocity of gas, in passing through the scrubber, should be reduced to obtain effective results, and the application of the water should be such as to insure the passing of the gases through sufficient curtains of sprays, to reduce the temperature and thoroughly wash them. To obtain satisfactory results the temperature of the gas should be reduced to 100 or 110 deg. Fahr. and the velocity should be at the rate of 300 to 350 ft. per minute, the quantity of water required depending on the quantity and temperature of the gases to be scrubbed.

The water should be applied so as to require all gases to pass through the curtains of water. The velocity of gas should not permit the water to be carried back or to short circuit, so as to prevent sufficient contact. The pressure on the spray nozzles should be such as not to offer too great resistance to the gas, and when using low pressure on the nozzles they should be spaced sufficiently near each other to give the desired curtains of water.

Estimates of the cost of carrying out the work as recommended have not been worked out in detail. An approximate figure for eliminating the public nuisance is as follows: For the New York Disposal Corporation, $100,000; the Thomas F. White Company plant, $7,000; and the Products Manufacturing Company, $25,000. These amounts might be somewhat reduced after a detail study of design and application.

No attempt has been made by Mr. Osborn to state in detail what steps should be taken, and in just what way the work should be done, as it was the object of the investigation only to determine in what way it could be done and whether it was feasible.

RECOMMENDATIONS

As a result of the studies and investigations covered in this report the following recommendations are made for the New York Disposal Corporation plant:

1. That immediate changes be made in the treatment of the insoluble gases vented from digesters through condensers, so as entirely to deodorize them, as the present practice of discharging into the boiler furnace does not deodorize the gases.
2. That special attention be given to keeping all tanks containing digested garbage, or garbage in the process of digestion, free from leaks, and that equipment not absolutely free from leaks when under pressure be kept out of service until repairs are made.
3. That gases shall not be permitted to escape at the time of opening digesters.
4. That special attention be given to all condensers to insure sufficient water being used, and at a temperature that will condense all the steam and take up all soluble gases.
5. That the present dryer plant be so constructed or changed as to prevent leakage, and reduce the amount of gases to be treated.
6. That all gases given off from the dryers shall be thoroughly scrubbed and deodorized before being allowed to escape to the atmosphere.
7. That the scrubber now installed be replaced or reconstructed, to enable the volume of gas passing through it to be thoroughly washed or scrubbed.
8. That the water supply at the plant be increased and, where necessary, pumps to be duplicated to insure sufficient water for condensing and scrubbing of gases at all times.
9. That the pumps be of a type that will assure the required amount of water being delivered and fitted with meters to show the amount used.
10. That the works and grounds at all times be kept in a clean condition.
11. That the city at all times have inspections made to determine the manner in which the work is being done.

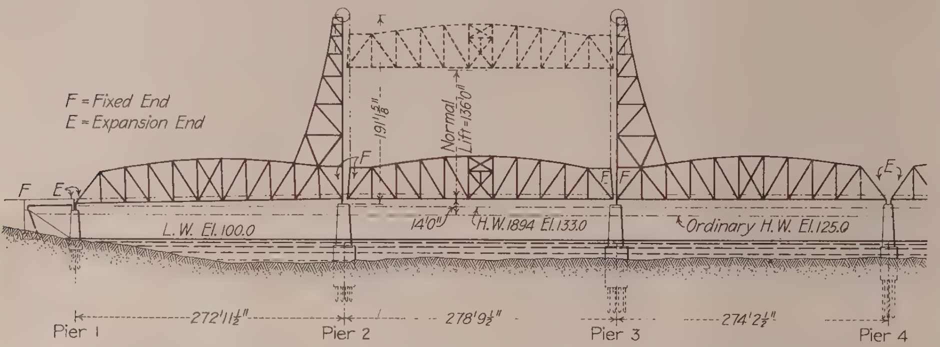
The report is followed by a detailed account of investigations made at the Barren Island plants by the city's Central Testing Laboratory, under the direction of Otto H. Klein.

A NEW STEEL PLANT IN AUSTRALIA began operations about the middle of March by the "blowing in" of a 350-ton blast furnace. One blast furnace, three open-hearth furnaces and a combination structural steel and rail mill have been completed, and sixty by-product coke ovens are under construction, all at Newcastle, New South Wales. The plant is owned and operated by the Broken Hill Proprietary Company, Ltd., of Australia, which company controls large iron-ore deposits in South Australia. The expert steel workers have been brought from various steel centers in the United States, and are, in general, under a three-year contract.

Special Pier and Floor Design Feature Pacific Highway Interstate Bridge

Riveted Steel Spans and One Lift Span Over Columbia River to Connect Vancouver, Washington, with Portland, Oregon—Curved I-Beams Used in Floor

UNUSUAL design of piers and floor system characterized the new Interstate Bridge to be constructed over the Columbia River valley, at a cost of about $1,500,000. This bridge with its approaches will extend for a distance of about 3¼ miles between the city limits of Vancouver, Wash., and the city limits of Portland, Ore. It forms one of the most expensive sections of the series of highways, included under the term "Pacific Highway," which is to extend from Vancouver, B. C., to San Diego, Cal. The distinctive features of the steel structure, which is fireproof in every particular, are the concrete piers supported on very long timber piles and constructed of two cylindrical shafts connected by a 30-in. cross wall, the curved I-beams which support the reinforced-concrete slab floor and the two-gage double-track trolley lines, and the results of comparative designs and alternative bids on draw-span versus lift-span construction for the required clear opening.



LIFT SPAN AND TYPICAL SIMPLE SPANS OF MAIN CROSSING, 3531½ FEET LONG

The Vancouver end is shown. To the right of pier 4 are ten spans each about 265 ft. long.

The main channel of the Columbia River at the site is 3500 ft. wide, with a maximum depth of 30 ft. at extreme low water and with variations from extreme low to extreme high water of 33 ft. The water rises each spring about 20 ft. and generally once in four years about 25 ft. It has reached 33 ft. only once in known history. The bed of the river consists of sand with a small amount of gravel, extending to a great depth. At the North shore very compact cemented gravel is found a few feet from the surface, dropping off to 100 ft. below about 700 ft. from the North shore. Over the remainder of the river only sand, with some gravel, was found to depths of more than 100 ft. The average elevation of the ground across the river valley is from 12 to 15 ft. above low water, so that much of it is inundated at every high-water period.

The Oregon Slough forms an important secondary channel, particularly for flood conditions. It is about 1000 ft. wide and 25 ft. deep, and is separated from the main river by an island about 1500 ft. wide. The Columbia Slough provides some drainage near the Oregon side of the valley, and is about 300 ft. wide and 20 ft. deep at low water. The bottom is of clay and sand, and hard compact gravel is found about 80 ft. below low water.

About 5000 lin. ft. of steel bridge structure and 12,000 ft. of embankment, with a secondary approach on the Oregon side for which about 6000 ft. of embankment will be built at the present time, will be used to form the crossings. The main crossing over the Columbia River consists of a series of through riveted truss spans with curved top chords, three spans 275 ft. long and ten spans 265 ft. long, together with a small deck girder span at the Vancouver end, making a total length of 3531½ ft. between end shoes.

Provision for navigation on the river is made by a vertical lift span. The central of the three 275-ft. spans is arranged to lift between towers on the other two spans so as to afford a channel 250 ft. wide at right angles to the current of the river, and 150 ft. high above ordinary high water, as shown on one of the accompanying drawings. The trusses are spaced 41 ft. center to center, with a 38-ft. roadway between them, and one sidewalk supported on brackets on one truss.

Special Pier Design

The river at the site of the bridge is subject to a certain amount of scour, but inspection of the soundings taken for many years past fails to disclose any indication of scour to extreme or unusual depth, although the river both for some distance upstream and about 3 miles downstream is deeper than at the site. The exceptional facilities for securing piles of great length at a very reasonable cost was a considerable factor in determining upon the exact type of piers to be used.

The piers are to be constructed of concrete, containing and resting on piles sunk by means of water jets to a depth of about 105 ft. below low water. Open cribs of timber, braced transversely and forming permanent parts of the pier bases, will be sunk to a depth of 20 or 25 ft. below the river bed, and the piles will be jetted down inside the cribs, averaging about one pile to 10 sq. ft. area. The details are indicated on one of the drawings.

Concrete will be deposited through the water in sufficient quantities to seal the bottom of the crib, and after this concrete has hardened the crib will be pumped out, the piles cut off a short distance below low water, and the remainder of the concrete for the pier placed in the open. The piles used will thus be about 120 ft. long, 10 or 12 in. in diameter at the top and 22 in. at the butt. Piles of this length can be purchased at the bridge site for about 12 cents per linear foot. In the typical piers under the 265-ft. spans there are ninety piles spaced about 3 ft. on centers as shown.

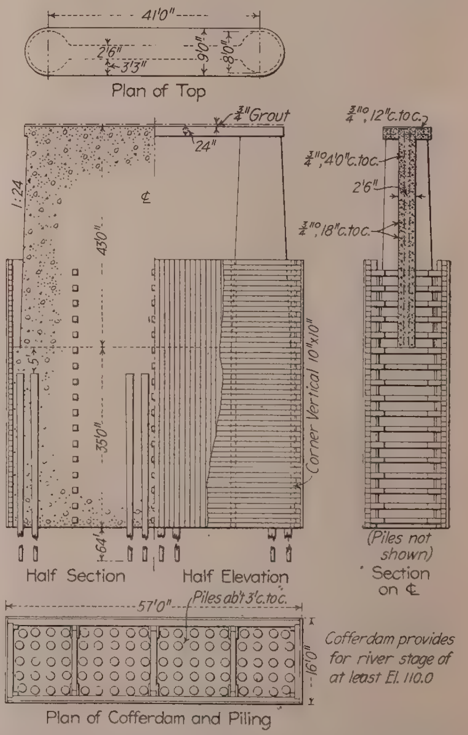
The upper ends of these piles are embedded from 15 to 20 ft. in the concrete of the base of the piers so that the pile forms a definite part of the pier. It is evident that even though some unusual scour should extend below the bottom of the base, the pier would still be perfectly stable. The occurrence of ice on the Columbia River is very rare, so that the concrete piers need no special protection of steel or stone facing. The shafts of the piers above the base are composed of two cylindrical battered concrete columns, one placed under each pair of bridge shoes. These columns are joined by a vertical cross wall and by a horizontal coping at the top, both of which are reinforced with steel. There is thus afforded a considerable saving of weight upon the supporting piles and the elimination of a large amount of unnecessary concrete.

Loads and Impact Allowance

The live loads for which the structure is designed are as follows: For the floor system, 50-ton cars on both tracks, 12-ton motor trucks (with special provision for a 24-ton machinery truck) and class A uniform loading on the roadway, 120 lb. per square foot on the sidewalks; for impact allowance 50 per cent added to all the above loads except for the sidewalks; for the trusses and girders 40-ton cars on both tracks and class B uniform loading on the roadway, with impact allowances according to the following formulas:

Street car loading, $I = 230/(NL + 300)$
Roadway loading, $I = 180/(NL + 30)$

in which L is length of load producing maximum stress and N the number of loaded tracks or of lines of traffic. In no case shall impact be greater than 50 per



TYPICAL PIER 4 SHOWING CROSS WALL AND PERMANENT COFFERDAM CONSTRUCTION cent. Class A and class B uniform loads vary with the length of truss or girder considered.

The working stresses conform to the regular specifications of the consulting engineers, which are practically the same as the A. R. E. A. standard specifications. The large number of duplicate spans and the complete detailed plans furnished to the contractors contributed toward securing low unit prices from the steel contractors. Erection without the use of falsework is planned by the erectors, who will erect, rivet and paint the spans on a dock at the shore, transfer them to barges and float them to position on the piers.

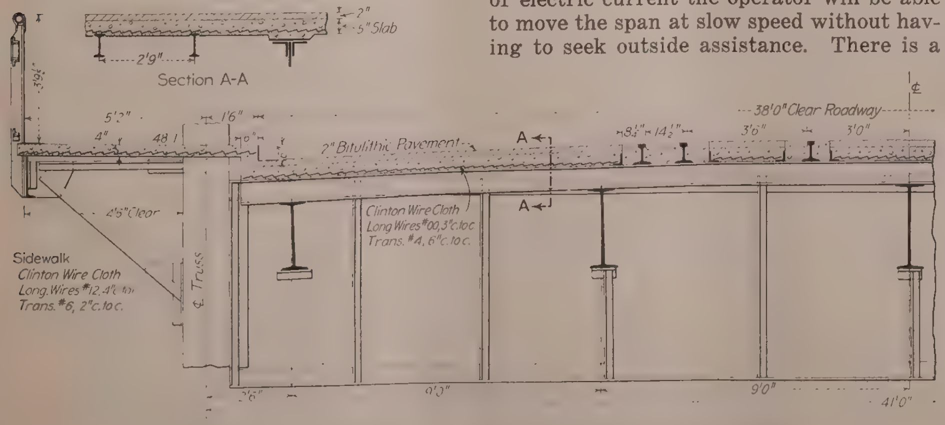
FLOOR WITH CURVED I-BEAMS

The reinforced-concrete slab floor is supported upon curved 8-in. I-beams bent to conform to the crown of the roadway and spaced about 33 in. apart. These beams extend entirely across the roadway and rest on longitudinal I-beam stringers spaced about 9 ft. apart as shown in the cross-sections, which show the floor and sidewalk details for both the truss spans and the short plate girder spans. Six 7-in. rails for the two-gage double-track street car lines are supported directly on the top flanges of the curved cross beams, to which they are fastened by standard Carnegie steel-tie clips. It is seen that the surfacing is a special 2-in. bituminous concrete which, with the 5-in. slabs, makes up the 7-in. height of rail. To afford access to the rails without injury to the roadway slab, a 5-in. space on each side of each rail is filled with concrete, as shown, and a flangeway provided by curving the top of this concrete.

It is proposed to bend the cross beams by shimming up the hot beds upon which the I-beams are run at the mill, and allowing them to form to the proper curve while cooling. The expansion joints are made by the usual type of checkered plates supported on angles upon which they slide. For the rail splices at the expansion ends manganese steel castings are placed beside the webs and one side of the rail head is planed off. Two fixed ends and two expansion ends are placed adjacent in order to reduce the number of expansion joints to a minimum. Owing to the lateral stiffness of the floor the lower laterals are lighter than would otherwise be required. Drainage intakes with downspouts are placed at 50-ft. intervals along each curb.

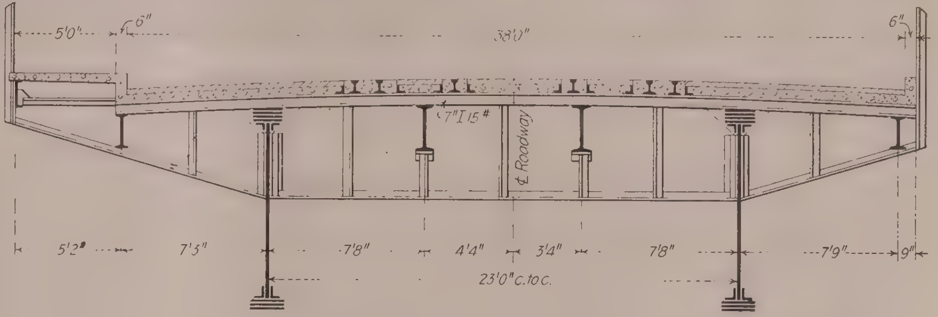
DETAILS OF LIFT SPAN

The 275-ft. lift span is suspended from each of its four corners by sixteen plow-steel 2-in. wire ropes which pass over cast-steel sheaves, 12 ft. in diameter, supported on the steel towers as shown and attached by a group of equalizing levers to concrete counterweights built around a steel frame. The towers are of simple riveted construction arranged so that the outer columns support all the load and the other members framing upon the adjacent trusses act as bracing only. The span is guided by cast-steel jaws which engage tracks on the tower columns. At one end these jaws guide both laterally and longitudinally and at the other end laterally only, thus allowing for expansion and contraction and for any slight variation in the relative position of the towers.



HALF SECTION OF ROADWAY AT TRUSSES, SHOWING CURVED I-BEAMS

Operation is effected by means of tables, of which there are two pairs at each corner of the span. The operating machinery, which is placed on the span at its center just above the roadway clearance, consists of four spirally grooved drums connected by a train of gears to an electric motor. Each of these drums controls the operating rope for one corner of the spans. All of the drums are connected so that when they are operated in one direction ropes leading to the tops of the towers are wound upon the drums, and those leading to the bottom of the towers are played off, lifting the span by the force exerted upon the corner sheaves. The machinery for operation is thus exceedingly simple—one transverse shaft extending across the span, one pair of reduction gears in a frame inside of the house and the back gears on the motor. An indicator and a limit switch are provided, by which the current is automatically cut off and solenoid brakes are applied to the motors near the upper and near the lower limits of the run of the spans.



SECTION OF ROADWAY FOR GIRDER SPANS—BRACKETS SUPPORT OUTSIDE STRINGERS

EMERGENCY OPERATION

To provide for emergency operation the span is equipped with a small gasoline engine connected through a speed reducer to the machinery, so that in case of failure of electric current the operator will be able to move the span at slow speed without having to seek outside assistance. There is a manually operated lock at each end of the span in connection with a centering device, so that the span may be locked down. The solenoid brakes in connection with the down haul rope also serve as a lock.

When the span is at its upper limit the counterweights are 2 ft. from the floor level, and special provision for the trolley wires under the counterweights must be made. A swinging frame on which the trolley wires are fastened is pushed down by the counterweights and returned to position by means of a small counterbalance. The rail connections at the ends of the movable span are simple scarfed joints so that the span lifts away from the fixed rails and returns to them without any movable devices.

At the ends of the fixed span adjacent to the movable spans there are provided roadway gates of substantial design to make an effective barrier across the roadway, and these are connected to the derailing switches in the street-car tracks so that when the gate is closed across the roadway, the derail is thrown. These gates will be manually operated, and a small steel and concrete cabin is provided at each for the gate tender.

RELATIVE COST OF LIFT AND DRAW SPANS

Several types of movable spans to provide the necessary channel opening for river navigation were considered, and the matter was narrowed to the selection of either a swing span or a vertical lift span. Alternate plans were prepared for the structure, one for each of these two types of movable spans, and designs made according to the same specifications and as nearly duplicate in character as possible. Application was made to the War Department and tentative approval was received for either type of movable span, provided the swing span should have two channels 200 ft. wide, and the lift span should provide one channel 250 ft. wide, with a vertical clearance of 150 ft. above normal high water.

Bids were received on both types of structure, and it developed that the lowest bid for the bridge with lift span was $70,000 less than for that with swing span. The lift span as above described was therefore adopted, not only for the advantage of the lower first cost, but also because, judging from experience in operating bridges of both types, there will be continued advantage in lower cost of operation and maintenance. It is likewise advantageous for river navigation, in that it provides a channel 250 ft. instead of 200 ft. wide, not hampered by the long draw protection required for the swing span. As the main channel is close to the Vancouver shore, the draw protection, about 500 ft. long, would have been a serious detriment to the dock frontage adjacent to the bridge.

The construction of the bridge is the result of a popular movement originated by the commercial clubs of Vancouver and of Portland. An attempt was made to have the structure built by the two States, but when this was not successful the two counties provided funds by issuing general county bonds, after an election voting them almost unanimously. Multnomah County, Oregon, issued bonds for $1,250,000, and Clarke County, Washington, for $500,000. The contracts covering the total construction were let for $230,000 less than the money available.

The bridge is being constructed under the direction of the Columbia River Interstate Bridge Commission, comprising the bridge commissioners of Clarke County, Washington, and of Multnomah County, Oregon, with the Governor of Oregon acting in some cases. The consulting engineers, Harrington, Howard & Ash, of Kansas City, prepared complete detailed plans covering every feature of the structure and complete and definite specifications for every part. E. E. Howard, one of the consulting engineers, furnished the information for this article. Bids were called for on the unit basis, and applied to the approximate quantities of the various materials as given in the specifications. In order to secure the best possible competition, the total contract was divided into twelve units and into such divisions as seemed naturally applicable.

The contract for the superstructure of the main Columbia River Bridge was let to the U. S. Steel Products Company. The steelwork for the girder spans of the Slough bridges is furnished by the Northwest Steel Company, of Portland, Ore. The erection and painting will be done by Porter Brothers, contractors, of Portland. The substructure contract went to the Pacific Bridge Company, of Portland. The concrete floor will be placed and the pavement laid by the Warren Construction Company, also of Portland. It is expected that the bridge will be in service late in the fall of the year 1916.

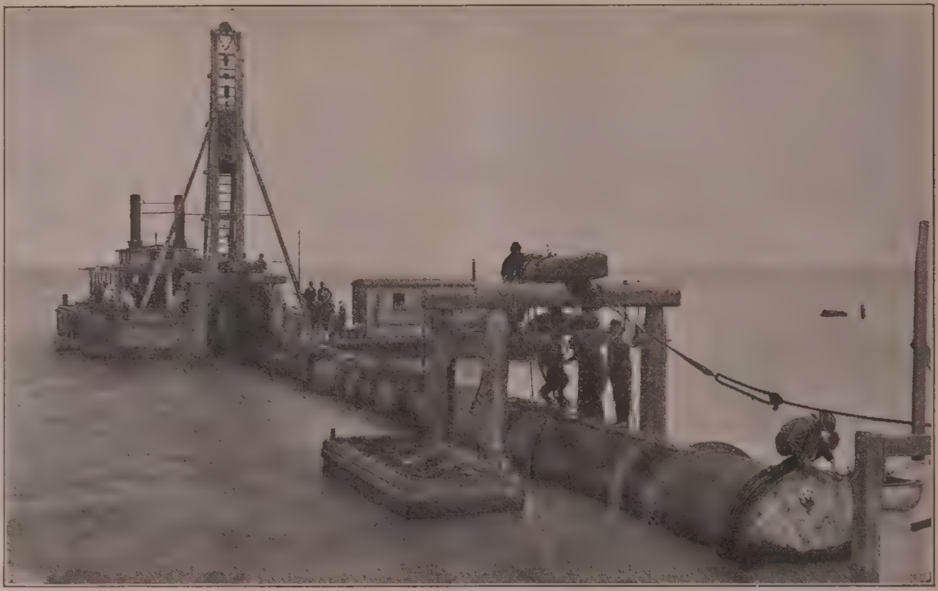
Complete Railway Aids Construction of Welland Ship Canal

A DOUBLE-TRACK railway, built with stone ballast and 60-lb. rail, has been built by the Canadian Government in connection with the construction of the Welland Ship Canal.

The railway extends from a point just north of the town of Thorold to Lake Ontario, a distance of seven miles, and its construction is for the purpose of handling excavated material from the canal prism to two long dumps in the lake forming the new Lake Ontario entrance to the canal, and for the handling of crushed stone excavated from the site of the flight locks in Thorold to the other lock sections of the canal to be used as aggregate for concrete. A large crushing plant has been erected with a capacity of 4000 tons per day, and both this plant and the railway are now in active operation.

Since it is expected that during the summer, when all contracts are under way, there will be a train every five minutes, the entire line has been equipped with a block signal system.

The construction of the road was in charge of J. F. Pringle, railway engineer, under the direction of J. L. Weller, engineer-in-charge, Welland Ship Canal.



READY TO OPEN VALVES TO FILL SECTION WITH WATER AND SINK IT

7000-Foot Pipe Line Floated to Place in Lake Ontario in Long Sections

Lowered and Placed from Pile Bucks and Connected with Special Submarine Joints by a Diver—Terminus of Line in Large Timber Crib

By N. ADELBERT BROWN
Special Assistant Engineer, Rochester, N. Y.

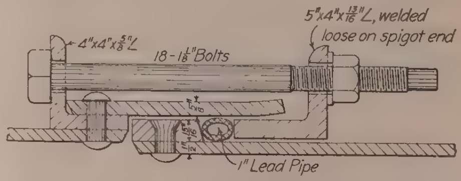
A SIXTY-SIX-INCH steel pipe line was recently laid in the bed of Lake Ontario for the discharge from the Rochester sewage-disposal plant by floating it into place in long sections, filling the sections with water, lowering them from pile bucks and connecting them with a special submarine joint. The discharge line extends from the end of the plant to the shore of Lake Ontario, a distance of 1900 ft., in open trench. From this point the pipe is submerged and laid in a dredged trench, terminating in a timber crib 7000 ft. from shore.

The straight sections of the pipe are of the lock-bar type, 66 in. in diameter, made of ½-in. steel plate in 30-ft. tapered sections. The pipe for the land section was unloaded on the site of the work. That for the lake section was delivered at a yard on the river, 2 miles away. A shallow beach and a main-line railroad track made the launching of long sections of pipe at the work practically impossible. At the yard the pipe was riveted into lengths of 120 and 160 ft. The shorter lengths were used at the outer end, where the piles would not bear the heavier loading, and near shore, where the wave action would not permit dredging long trenches.

SUBMARINE JOINT SIMPLE AND FLEXIBLE

At the ends of these pieces submarine joints, similar to those used on the intake pipe, at Erie, Pa., were placed. The joint consists of a welded angle and papered ring riveted to one end of the pipe to form the bell, and a flat ring riveted to the other end, with a lead gasket and a loose angle-ring follower to form the spigot. Bolts through the angle rings draw the gasket between the flat ring and the sides and hub of the bell. This gives a tight and slightly flexible joint. A slip joint to take up expansion was provided where the land and lake sections of the line join.

The line ends in a three-way tee, having one 66-in. and two 38-in. outlets. This tee is placed in a crib to protect it from anchors and raise the discharge above the bottom of the lake. The crib is 46 ft. square and 24 ft. high. It is built of 12 x 12-in. timbers, and divided into twenty-five pockets. These were filled with stone, except where occupied by the pipe, and the crib was surrounded with riprap. The sills of the crib are 4 ft. below the bottom of the lake and the top is 26 ft. below low water.



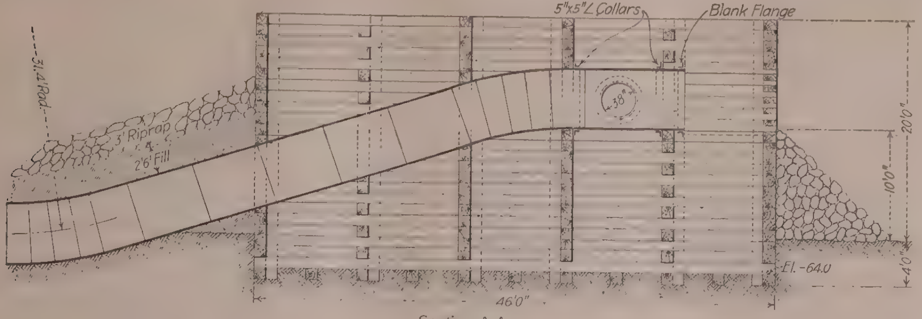
JOINT EASY TO CONNECT UNDER WATER

HYDRAULIC DREDGE DIGS TRENCH

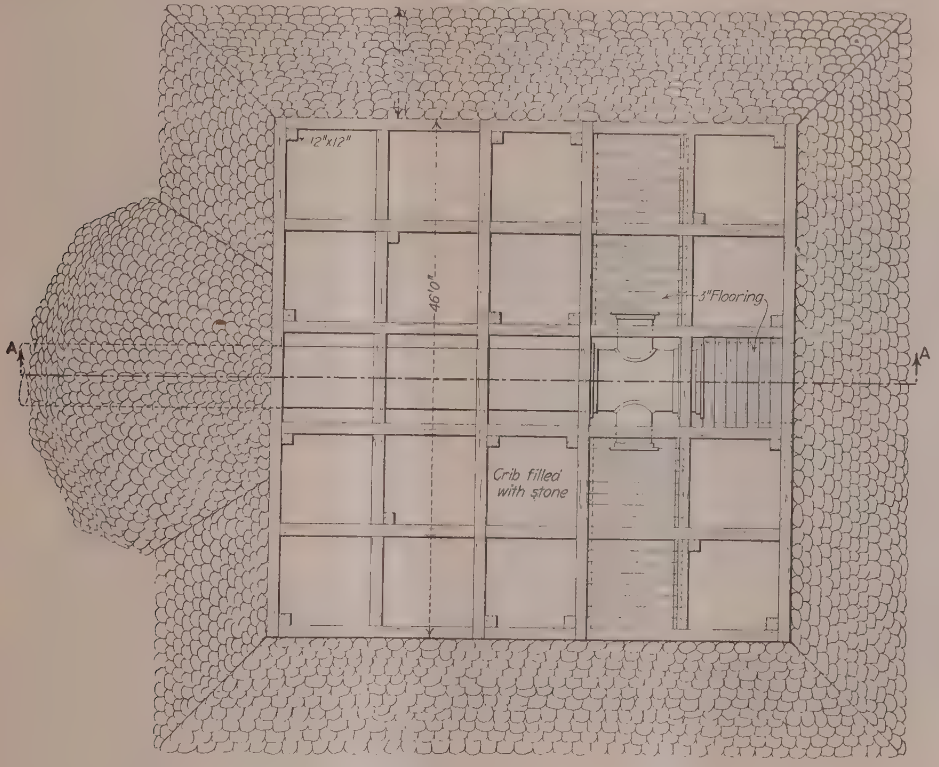
An 8-ft. trench was excavated by a hydraulic dredge to allow 2½ ft. of cover over the pipe. No attempt was made to excavate holes for the joints, as it was found to be more satisfactory to do this with a jet as the pipe was laid. In the excavation it was found that the fine sand would stand on a 1:1 slope. Where clay was mixed with the sand the slope was 4:1.

Work started at the crib and progressed toward shore. After the excavation was made the location of the crib was marked on three sides with piles. The crib was towed to position and suspended by cables from two derrick scows, and the pockets were filled with stone. It was then gradually lowered to place.

To lay a section of pipe a buck of four piles was driven at each end of the section.



Section A-A



Plan

STONE-FILLED CRIB PROTECTS END OF DISCHARGE FROM DISPOSAL PLANT

These piles were built up of three 5 x 12-in. timbers, were driven 10 or 12 ft. in the ground and extended 10 ft. above water. They were driven on 14-ft. centers and the tops were drawn to 10-ft. caps to give stiffness. They were capped across the pipe line with round timbers, and the two bents were tied together along the line with 2 x 8-in. plank, on which other plank were laid to form a working platform. On the caps another round timber was set, parallel with and over the line of the pipe. A set of Manila rope falls was hung from the upper cap on a U-bolt. When the rigging was in place a pipe section, which had been bulkheaded and launched at the yard, was towed to position between the piles, and cables were placed around each end of it and shackled to the lower block of the falls. Valves in the bulkheads were then opened and the pipe was filled with water, after which the tackles were slacked off by hand and the pipe was lowered to place. When near grade a diver descended, removed the bulkheads and directed the work from below. A line from the middle of the pipe extending to the forward pile buck, was held taut as the pipe descended, swinging the pipe endways away from the bell already on the bottom. When at grade this line was slacked and the spigot slipped into the bell. The bolts were entered by the diver, but the nuts were drawn up by men at the surface with a tackle attached to a ratchet wrench.

To permit the removal of all tackle before backfilling, a cable was passed under the free end of each section of pipe and drawn up to the caps with eyebolts. After the backfill had settled these cables were removed and the piles pulled.

The work was done by the T. A. Gillespie Company and completed in fourteen months. The contract price, which included furnishing and laying both the land and lake sections, was $250,000.

PANAMA CANAL TOLL EARNINGS reached the $4,000,000 mark Sunday, June 6. The earnings during May were $547,054.60.

Compares Losses in Concrete and Mortar Lined Canals

Reclamation Engineer Concludes from Experiments That Concrete Made with Clean Sand and Gravel Is Superior to Mortar

WATER LOSSES in concrete and mortar lined canals have been observed for some time by H. D. Newell, project manager of the Umatilla reclamation project in Oregon. In the June "Reclamation Record" he gives the following data, which include losses due to seepage and evaporation:

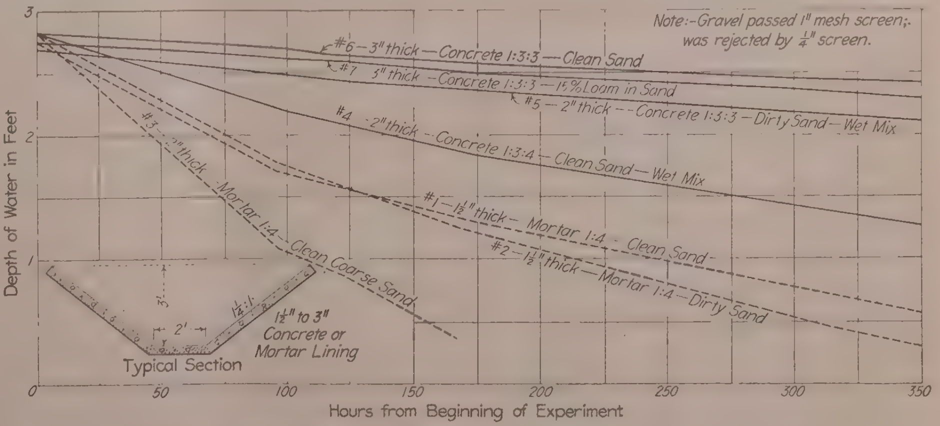
In 1910 a section of canal about 1000 ft. long, located in a sandy fill, was lined with a 1-in. thickness of mortar composed of 1 part of cement to 4 parts of sand. This section has a bottom width of 3 ft., a depth of 2 ft., and 1½:1 side slopes. Dams were placed at either end, and observations indicated a loss of 0.2 ft. vertically in twenty-four hours. The lining passed through several winters without injurious effects from frost.

In 1911 another canal was lined with a 1½-in. thickness of 1:4 mortar. This section has a bottom width of 4 ft., a depth of 4 ft., and 1¼:1 side slopes. The lining was somewhat damaged by frost. Observations made the following summer indicated that the losses on the 2.2-mile length of canal were less than the probable error of the measuring instruments.

In 1913 a section of small lined canal was constructed in a sandy formation for experimental purposes. It was divided into seven sections, each 8 ft. long in the clear, by concrete walls 4 in. thick. When these basins were first filled with water the seepage losses were quite large. After one or two preliminary wettings all the basins were filled, and observations continued for fifteen days. The results are shown graphically in the accompanying diagram.

REDUCED RATE OF LOSS AS DEPTH OF WATER DECREASES

A noteworthy point indicated by the diagram is the reduced rate of loss as the depth of water decreased, as indicated by the slope of the lines. This tendency is less marked for sections 5, 6 and 7, which probably indicates that these losses are principally the results of evaporation, which is independent of the depth, as is further shown by the records of evaporation from the Cold Springs reservoir on this project. The latter showed a loss by evaporation of about 0.03 ft. in twenty-four hours, and it is probable that the loss from the canal section was greater than this, as it was located on the south slope of a sand pit.

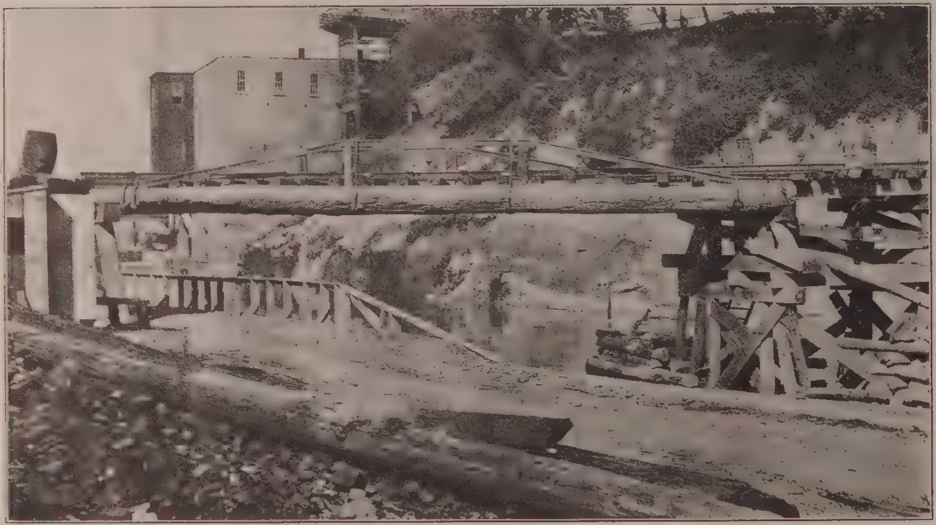


CURVES SHOW SUPERIORITY OF CONCRETE OVER MORTAR FOR CANAL LININGS

Inverted Bridge Which Should Have Failed Carries Heavy Load

THE BRIDGE of 45-ft. clear span, shown in the accompanying photograph, has supported three 15-ton dinkies at one time, in spite of predictions that it would collapse when thus loaded. The rails forming its compression members are practically unsupported laterally from end to end. If the sticks forming the "tension members" were free to deflect, as a line of pin-connected eye-bars would be, a concentrated load of 6 tons on the middle of the bridge would crumple both rails.

The two logs, depending on their soundness, would support a concentrated load of 10 to 16 tons at the center of the span without breaking. They undoubtedly deserve full credit for the fact that the bridge did not collapse, although they are said to be old white pine "glance booms," or floating fenders, that have been water soaked for years and later thoroughly dried out.



THIS BRIDGE IS SAID TO HAVE SUPPORTED TWO 15-TON DINKIES

If the rails had been put underneath, as could have been done by raising the grade of the track, thus inverting the structure, they would easily have supported a concentrated load at the center of the span more than equal to the three 15-ton dinkies, and that without putting the logs in any danger from compression.

REDUCING ROAD TRANSPORTATION COST in Kansas by only 2 cents per ton-mile, according to the State highway commission in its latest biennial report, would mean a saving to the consumer or an increase to the farmer of nearly $1,500,000 per year. The cost of transportation by water is about ¼ cent and by rail about 4/5 cent per ton-mile. On a well-improved public highway the cost of hauling is from 5 to 12 cents per ton-mile, and on an ordinary road from 20 to 50 cents per ton-mile. The average cost of hauling farm products in the United States is 23 cents per ton-mile. A careful investigation in Kansas has shown that the weight of the average load of farm products is 2960 lb., the average length of haul to market is 5.5 miles, the average time required to make a round trip is 4.5 hours, and the average cost of hiring a driver and a two-horse team and wagon for a 10-hour day is $3.50. This gives an average of 21.5 cents per ton-mile, or about thirty times as much as by rail.

Prolonged Stress and Corrosion Crack Copper Alloys

Tests by Ernst Jonson Indicate That 20,000 Pounds per Square Inch Is Practical Ultimate Strength for This Group of Materials

LONG-TIME tension tests of copper alloys, exposed to ammonia for the purpose of providing conditions of accelerated corrosion, have disclosed the fact that cracks are liable to occur when the stress exceeds 20,000 lb. per square inch. This is the conclusion reached by Ernst Jonson, engineer-inspector in charge of the testing laboratory of the New York Board of Water Supply, in a paper, "Fatigue of Copper Alloys," presented before the American Society for Testing Materials at its annual meeting in Atlantic City, N. J., June 22-26. Mr. Jonson discussed the same subject in an article, "The Cracking of Drawn Brass," in the Engineering Record of April 11, 1914, page 415.

From the results of his investigations, Mr. Jonson concluded that the ordinary ultimate strength of brass is developed only when the metal is broken so quickly that cracks do not have time to develop, and that when a stress exceeding the yield point is applied for a considerable time the metal will fail by cracking. The working hypothesis formed for the purpose of co-ordinating these facts and to guide further investigations is as follows:

CORROSION WEAKENS FLAWS

In copper alloys there are microscopic flaws. When the tensile stress approaches the yield point these flaws are opened sufficiently to admit corrosion. This corrosion weakens the edges of the flaws and causes them to increase under the continued action of the stress, and thus a continuous crack is formed which gradually increases in depth. When the crack has so reduced the cross-section that the stress on the remaining solid portion exceeds the ultimate strength, the rod breaks.

In order to determine more definitely the magnitude of the stress at which cracking begins another series of tests has been started. Each test was made as follows: A tension test specimen of 1 in. diameter and 8 in. length, with a reduced diameter of 0.8 in. and 6-in. gage length, was placed in the testing machine. A sheet steel cup with a 1-in. hole in its bottom was put on top of the lower grip so that the end of the test specimen passed through it, and the cup was filled with strong ammonia. Some absorbent cotton was tied to the test specimen so as to keep it wet by capillarity, and the cup and test specimen were covered by a conical paper hood so as to confine the ammonia fumes. A stress of 10,000 to 17,000 lb. per square inch, increased by increments of about 3000 lb. per square inch at intervals of a day or more, was applied to the test specimen. Under the higher stresses the test specimen continued to stretch for a considerable length of time, and in such cases this time was added to the interval between the additions of load.

The test specimen was examined before each increment of load was applied. When the first crack was seen the test was concluded, because experience has shown that a crack once started will increase in extent until the test specimen fails, even if the load is not increased. The cracks were similar to season cracks; the largest was generally found where the test specimen emerged from the liquid. In some cases this crack was the only one present; in others there were quite a number of cracks distributed over the length of the test specimen.

In order to discover what alloys are subject to failure by cracking all the usual copper alloys will be tested.

The stresses at cracking are as follows:

STRESSES OF COPPER ALLOYS AT CRACKING

	Kind of metal	Stress at cracking, lb. per sq. in.
No. 1.	Manganese bronze, plain extruded..	27,000
No. 2.	Manganese bronze, plain extruded..	23,000
No. 3.	Manganese bronze, plain extruded..	23,000
No. 4.	Naval brass, plain extruded......	20,000
No. 5.	Muntz metal, plain extruded.....	23,000
No. 6.	Gun metal, cast 88 Cu, 10 Sn, 2 Zn..	23,000

It appears that the stress at which cracking occurs bears some relation to the elastic limit, but this relation has not yet been definitely established. Present results indicate that the metal is liable to cracking when the stress exceeds the elastic limit by 5000 lb. per square inch.

EFFECT OF RED LEAD

Four specimens of manganese bronze have been under excessive stress for many months but have been protected from corrosion. These specimens have not cracked. Some manganese-bronze studs which were found cracked in valves in the Catskill Aqueduct were made up with red lead. One test bolt, therefore, was embedded in red-lead paste and drawn up to a stress in excess of the initial yield point. In the part of the bolt where the red lead remained liquid the surface of the metal was stained and cracks appeared.

Two specimens of plain-extruded manganese bronze were corroded, one in ammonia, the other in a mixture of ferric chloride and hydrochloric acid, and then broken in the testing machine. The specimens gave ultimate strengths of 65,300 and 60,000 lb. per square inch, and elongations of 43 and 42 per cent respectively. These results, which are quite normal, indicate that corrosion does not generally injure brass when it is not under stress while being corroded.

The results thus far obtained may be summed up as follows:

1. Prolonged excessive stress does not injure the metal when it is protected from corrosion while under stress.

2. Corrosion does not generally injure the metal when not accompanied by excessive stress.

3. Corrosion accompanied by prolonged stress less than 20,000 lb. per square inch does not generally injure the metal.

4. Corrosion by ammonia accompanied by a prolonged stress of 20,000 lb. per square inch or more causes cracking similar to season cracking.

5. The foregoing results apply to manganese bronze, naval brass, Muntz metal and gun metal.

6. No copper alloy has as yet been found to which these results do not apply. It is possible, however, that such exceptions exist, either on account of higher elastic limit or greater resistance to corrosion.

CONCLUSION

Practical experience with season cracking indicates that ammonia is not the only corrosive agent which causes cracking in overstressed copper alloys, but that the corrosion which results from the common conditions of exposure also produces cracking. Ammonia, therefore, may be regarded as a representative corrosive agent, although it attacks these alloys more quickly than the average exposure. The test with ammonia may be regarded as an accelerated test which in a few hours produces results which ordinarily would require days, weeks or months to develop, but which do not differ in kind from the results of the more common forms of exposure. Since all copper alloys in practical use are exposed to various corrosive agents it is probable that sooner or later all metal in use will be affected by corrosion, just as much as the test specimens in the tests here reported. Therefore, it follows that the results obtained from these tests may be expected wherever copper alloys are permanently stressed over 20,000 lb. per square inch.

It seems, therefore, that we are justified in drawing the conclusion that forgible brass and gun metal, and probably copper alloys in general, should never be stressed in practice to 20,000 lb. per square inch. In other words, 20,000 lb. per square inch should be regarded as the practical ultimate strength of this group of materials. The working stress should therefore be taken as a safe fraction of this stress, say 5000 lb. per square inch.

An important corollary of this conclusion is that the process of manufacturing rods of copper alloys must be so planned that no appreciable initial tensile stress is left in the surface of the rod, and that the proper inspection of drawn rods must include strain measurements. Another important corollary is that copper alloys cannot be depended on where the stress is indeterminate, for in such cases it may or may not exceed the safe stress. These alloys, therefore, should not be used for important bolts when there is the least occasion for drawing them up very tight.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Military Preparedness an Insurance for Peace

SIR:—I want to express my appreciation of the inclusion in the Engineering Record of June 19, page 768, of General Wood's article on "Military Preparedness an Insurance for Peace."

I do not know why any engineering journal should not point out just this kind of thing. It seems to me quite appropriate that the Engineering Record should give space to General Wood's excellent remarks on the hopelessness of unpreparedness. As engineers, we have a duty to perform in educating the public up to the fact that war is an engineering business, and that engineers are a very large factor in war, and that we cannot hope to have successful war without preparation.

I congratulate you on the spirit of the Record, which can take up patriotic questions of this kind.

JOHN W. ALVORD.

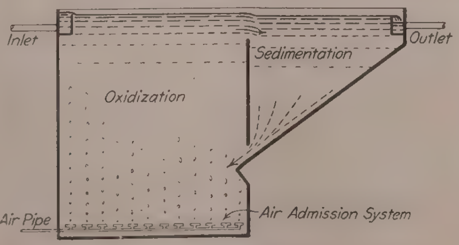
Chicago.

Activated Sludge and the Baltimore Sewage Experiments

SIR:—In operating the converted Imhoff tanks at Baltimore sewage treatment plant for the activated sludge experiments on a continuous flow basis there is danger of short circuiting, that is, that particles of raw sewage, due to the air agitation, will reach the outlet before the proper time of oxidation and reduce the degree of purification desired in the effluent. Indeed, short circuiting may prevail to such an extent as to defeat the whole object of the experiments. Both Mr. Schoonmaker and myself had this in mind two months ago.

It seems to me that a proper oxidation period will more nearly obtain when the flow of sewage through the oxidation and agitation chamber is perpendicular to the direction of the agitating air bubbles. In our experiments as laid out to fit the existing tanks the sewage flow is parallel to the direction of the air bubbles, that is, directly upward. I have noticed in our laboratory bottle experiments, where the air is admitted through a tube at the bottom of the bottles, that the liquid is displaced much more in a vertical than in a horizontal direction, or that the cycle of any particle of liquid has the shape of an oval or ellipse with its major axis vertical. This would seem to show that in a tank designed for horizontal flow all particles of sewage have a better chance of remaining in the oxidation chamber for the proper period than in a tank designed for vertical flow.

Owing to the lack of definite knowledge of the subject at the present time it is rather difficult to state how a horizontal-flow, activated-sludge tank should be designed. Experiments must be made and data collected upon the necessary oxidation and sedimentation periods, possible degrees of purification, quantity of air needed and length of time it will take the activated sludge to go back to its ordinary condition after aeration is discontinued.



SKETCH OF TANK WHERE FLOW IS PERPENDICULAR TO COURSE OF AIR

It may be possible to design a horizontal, continuous-flow, activated-sludge tank according to the accompanying sketch. If it is impossible to design the tank with the sedimentation compartment having a bottom steep enough to cause the sludge deposits to settle back into the oxidation chamber, then power-driven squeegees, endless chain-scrapers or false floor plates made to tip-tilt, perhaps would answer the purpose. In such a tank care should be taken to provide weirs or baffles to insure an even distribution of the inflowing sewage across the width of the tank.

GUSTAV J. REQUARDT,
Acting Division Engineer, Baltimore Sewerage Commission.
Baltimore.

Technical Literature Classification

SIR:—The Joint Committee on Classification of Technical Literature, 29 West Thirty-ninth Street, New York City, is extremely desirous of obtaining the assistance of your readers in making a collection of classifications of applied science which have been developed independently in the offices of manufacturing plants or engineering firms, especially those which exist in manuscript form, and have been used for filing or indexing data.

The committee would especially like to have copies of any extensions of present systems to cover any special industry or branch of engineering not now fully covered by the published classifications.

W. P. CUTTER,
New York City. Secretary.

Examinations Held After Positions Are Temporarily Filled

SIR: On page 753 of your issue of June 12 appears a letter from W. R. Robinson, secretary, Illinois State Civil Service Commission, animadverting an article on page 695 of your issue of May 29.

Mr. Robinson says "the bars are not 'let down for three of the positions,' as stated." He says further that the examination for these three positions "does not include a written test on technical matters." It consists of an inquiry into education, training, experience, personality and reputation, supplemented by an oral interview "which will afford an opportunity to judge the personality of the applicant."

May I inquire through your columns if it is not a fact that the three positions to be filled under this proposed examination are already held by "temporary" employees?

ROBERT ISHAM RANDOLPH.

Chicago.

[A copy of Mr. Randolph's letter was sent to the Illinois Civil Service Commission. In reply W. R. Robinson, secretary, states that with the exception of assistant chief utilities engineer, all of the positions under the Public Utilities Commission are now filled temporarily, pending the results of the examinations which have recently been announced.—EDITOR.]

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

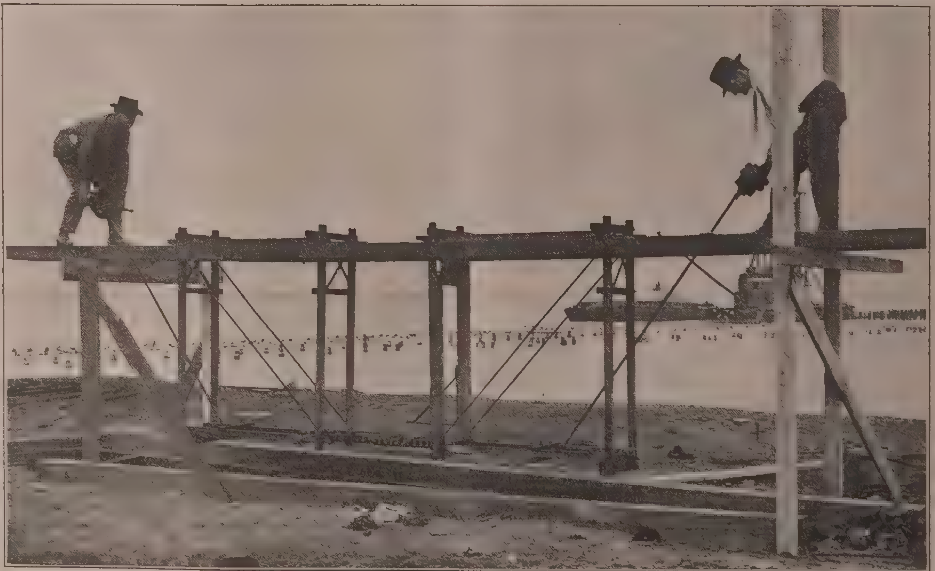
"Dirt Bucker" Used in Idaho for Making Fills Over Marshy Ground

FOR MAKING fills across marshy ground in connection with Idaho State road work, the device shown in the accompanying photograph, called a "dirt bucker," is used. It consists of an ordinary Fresno scraper fitted to the forward end of a frame supported on two wheels in the rear, similar to that of a "hay bucker" such as used on western ranches for moving hay from the field to a stacker. The material is pushed ahead of the team by the frame in making fills across wet, marshy places too soft to hold up the horses. The dirt is first dumped at the end of the fill and the "bucker" is simply used for pushing it ahead, taking the place of dump men. According to Edward S. Smith, Idaho State highway engineer, it has proved very effective and economical.

WITH THIS TOOL TEAM WORKS ON SOLID FILL TO SPREAD SPOIL IN SWAMP

Frame Enables Slanting Holes to Be Bored Under Water

A TIMBER frame, hung at correct line and grade from two guide-planks, was used to bore slanting holes in the piles under water for anchor rods on the Municipal Pier at Chicago. This pier was described on page 778 of the Engineering Record for June 19, 1915. The augers used were driven with compressed air. Operators are shown in the photograph standing on the frame to bore the holes, but this was not always done in rough weather. Above the guide blocks the long auger shanks are fitted with a universal joint, so that men could stand on an oscillating raft and keep the machines going even when the waves were quite high. The rods were inserted by men in rubber suits standing on a submerged raft. This was easy because of the accurate boring possible with the frame.



FRAME LINES SLANTING AUGER HOLES BORED WITH UNIVERSAL JOINT DRIVE

Unusual Rigging Used to Set Heavy Turbine Parts in Close Quarters

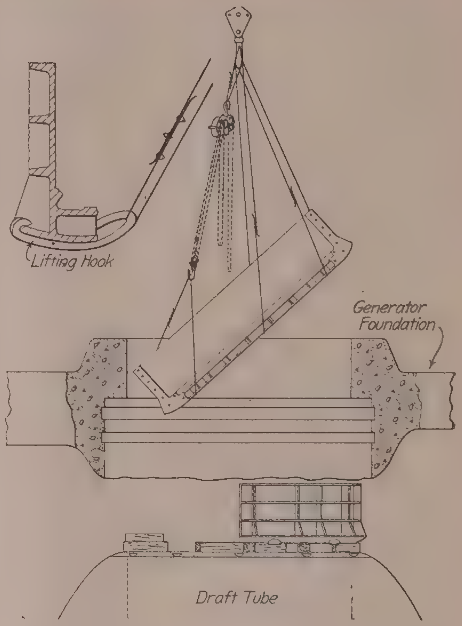
By F. M. BIERSACH

Erection Superintendent, Allis-Chalmers Manufacturing Company

IT was necessary to lower four half-ring castings, each half of one ring weighing 7 tons, and each half of the other, 9¼ tons, through an opening of less diameter than the rings in erecting the turbines for the Coon Rapids power plant of the Northern Mississippi River Power Company. The two halves of the base ring were each lowered to the top of the draft tube, or foundation, in three slings which hung them at an angle with the horizontal, allowing them to pass through the hole in the station floor which formed the generator foundation. Chain blocks were inserted in the longest sling to level up the casting after it had passed through this hole. The slings were kept from slipping by lugs on the castings.

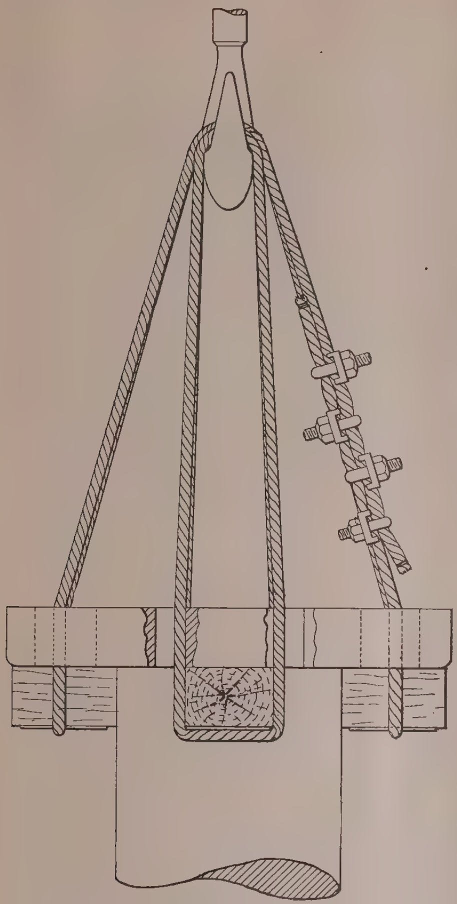
The bottom ring was assembled, aligned and leveled on jacks, and grouted into the top of the draft tube. The top ring was then lowered in the same way and assembled on blocking on the bottom ring. Four lifting hooks, shown in the sketch, were then slipped under the assembled ring and used to lift it into the recess left for it in the generator foundation above. Here it was blocked up while the distance bolts, spacing it from the base casting, were screwed into nuts grouted in with the lower casting. The upper ring was then lowered onto these bolts, which held it to proper elevation. The adjustment for line was made with four jacks set between the outside of the ring and the concrete, and the ring was grouted in.

The first of the five turbines was ready



CHAIN BLOCK HITCH ON HALF OF RING

Ring was assembled, bolted together and raised to position with four lifting hooks.



SLING OF SINGLE LENGTH OF WIRE ROPE HOISTED 38-TON RUNNER

DISTANCE BOLTS SPACE TOP-PIT RING FROM RING IN DRAFT TUBE

for installing the 38-ton solid cast-iron runner before the eye-bolt which was to be screwed into the shaft of each runner in turn to raise it had arrived on the job. The runner was successfully hoisted, however, by the flanged coupling at the top of the shaft. This coupling had eight bolt holes, through which a single length of ¾-in. steel cable was rove and clamped as indicated in the sketch. Wood blocks were inserted in each loop below the coupling to protect the cable from the sharp edges of the boltholes and equalize strains on the coupling, and the loops above the coupling equalized over the crane hook. This was done very carefully, and would have been impossible if four separate slings had been used. It enabled the runner to be suspended absolutely level.

This erection was carried out by the writer for the Allis-Chalmers Manufacturing Company.

Subway Undercrossing Walls Concreted from the Top Down

THICK concrete supporting walls are being placed from the top down in constructing the crossing of the Canal Street subway under the recently completed Center Street loop in New York City.

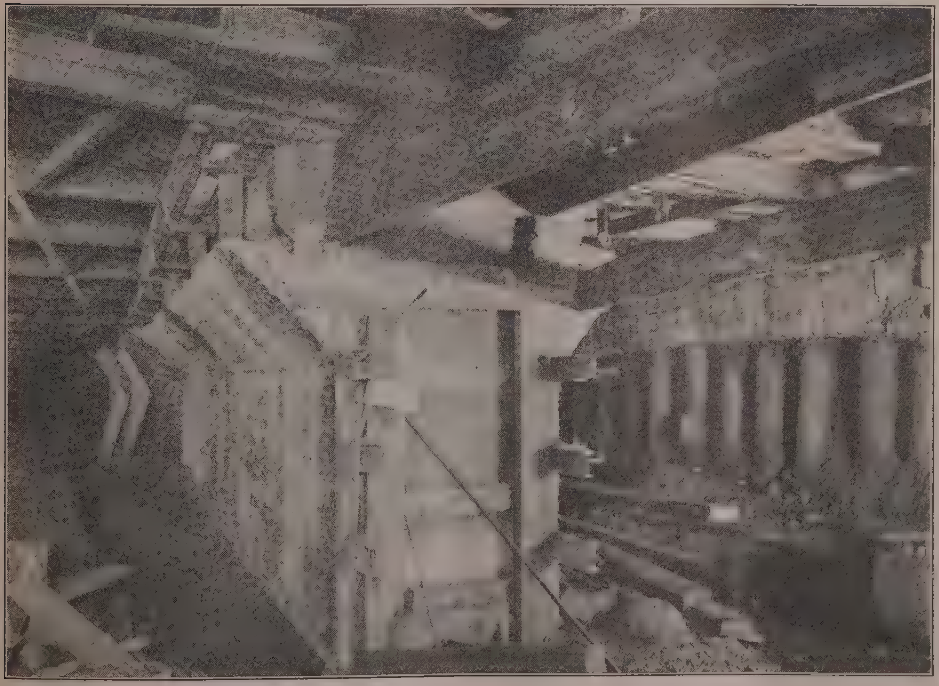
The weight of the Center Street subway is carried on rows of closely spaced metal pipe piles filled with concrete. These piles were spaced so as to clear the tracks and passageways of the new subway and to be entirely enclosed in walls of this latter work when completed. They were driven at the time the Center Street subway was built with the present Canal Street construction in view. The process of building the walls of this new subway not only gave additional weight to be supported but also destroyed partially the carrying value of the piles by exposing them and destroying skin friction and lateral support. It was necessary, therefore, to construct these walls in such a way as practically to underpin the overhead Center Street subway during the process.

The new subway passing below the present subways on Lafayette and Center Streets will connect the express tracks of the new Brooklyn rapid transit subway on Broadway with the Manhattan bridge. The contract is known as section 2 of route 20. As may be seen from the drawing on page 26 the Canal Street subway at this point consists of two tubes for express tracks and two footways, the latter connecting the stations of the three subways. The floor system of the Center Street subway is designed to span the two passageways and the two tubes and is supported by five concrete-encased transverse box girders. These were underpinned at the time they were built with two rows of piles each. These piles reach well below the subgrade of the new cut.

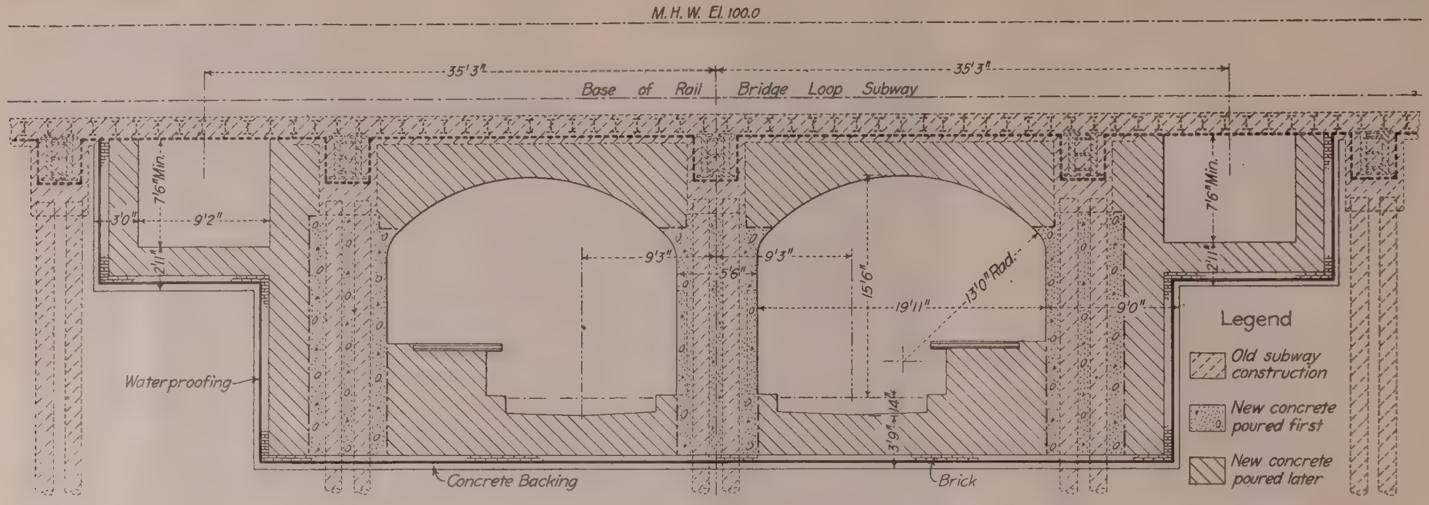
CONSTRUCTION METHODS

The construction method of the new work was to drive headings immediately under the floor of the present subway, exposing the girder capping the piles and about 6 ft. of the piles themselves. Forms were set up reaching above the spring of the arch and were poured from this shoulder. At first in a portion of this work the piles and cap were exposed for a considerable distance for the purpose of examination, and the walls were concreted in 20-ft. lengths. In the remaining portion of the first, or upper section only one piece of 20 ft. of wall was concreted at a time, and the piles were only exposed immediately in advance of this concreting. In this way only a small group of piles was robbed of lateral support and skin friction, and this group was immediately surrounded by a heavy concrete wall which not only supported the piles laterally but also had a firm bearing on the soil below, thus aiding in carrying the direct load.

While this concrete was setting up the



TOP SECTION OF MIDDLE WALL UNDER CANAL STREET SUBWAY CONCRETED FIRST—PILES EXPOSED AT RIGHT WERE LATER INCLOSED IN CONCRETE OF SIDE WALL



CENTER STREET SUBWAY SUPPORTED ON PILES PREVIOUSLY DRIVEN WHILE WALLS OF UNDERCROSSING WERE CONCRETED

balance of the necessary excavation between the walls was completed down to its base. Forms were then stripped and trenches were dug under these walls and around the piles, making the excavation deep enough to give working head-room and keeping above the level at which the ground water was held by the pumps. Forms were then set up in the trench and the concrete was poured through a shoulder at the top of this second form, which had to be chipped off later. This second section of wall was also concreted in 20 ft. panels and the trenching was only carried ahead fast enough to keep out of the way so all walls at all times had a firm bearing on the soil below except the 20 ft. panel then under construction. While this concrete was setting up the general excavation was carried down to its base. The forms will now be stripped and in the same general way trenches will be dug and the third section put in, taking the wall to subgrade. The arch and invert will be concreted last. The waterproofing is placed directly against the board lagging on the outside of the outside trenches and the walls concreted directly against it.

The present Center Street subway is in no way disturbed during these operations, the roof carrying several feet of backfill with the pipe lines, conduits, surface car tracks, etc. Concrete retaining walls, above the walls of the existing structure, on each side of Center Street, were poured in trenches and carefully backfilled before the main excavation began. This method avoided the necessity of decking Center Street and providing for overhead pipe crossings.

The Underpinning & Foundation Company is the contractor for this section. John B. Goldsborough is chief engineer of the company and W. T. McKibben is superintendent for this contract. For the Public Service Commission J. O. Shipman is division engineer for the first division, and A. J. Mayell is assistant division engineer, with B. A. Hodgdon section engineer.

Hydrochloric Bath Removes Rusty Scale from Reinforcing Bars

A BATH for rusty reinforcing rods has been obtained by the Chicago, Rock Island & Pacific track elevation engineers after much experimenting and is now being used in cleaning tons of rusty, scaly rods in connection with Chicago track elevation. The bath is composed of three parts of hydrochloric acid and one part of water. Two wooden troughs about 35 ft. long, 18 in. wide and 12 in. deep are used, one for the hydrochloric bath and the other for water only. The more badly rusted rods are left in the bath about 20 minutes, depending on the amount of rust. They are then washed in running water in the water box. Using one dollar's worth of acid, two men cleaned in an eight-hour day 1826 ⅞-in. and 1550 ½-in. rods, average length 30 ft.

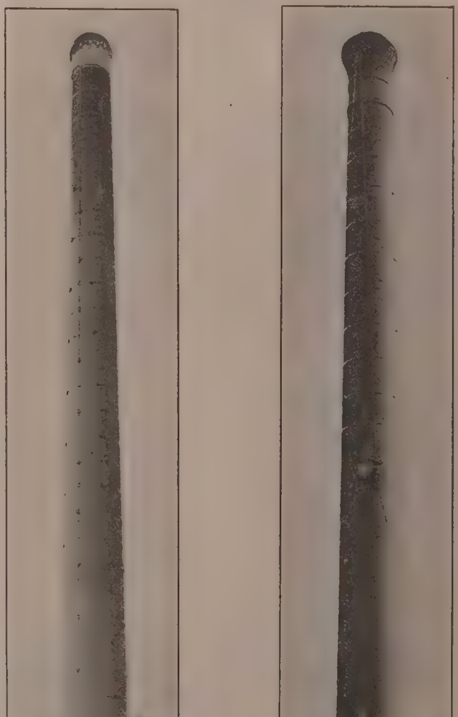
WATER WASHES ACID OFF CLEANED RODS

Tall Brick Stacks Repaired Rapidly Under Difficulties

WHAT is claimed to be the largest smokestack banding and repairing job while the chimney was in use has recently been completed for the Simmons Manufacturing Company, Kenosha, Wis. The top 12 ft. of the stack was torn down and rebuilt in three days. Several years ago the smokestack was struck by lightning and although the cracks that resulted had never proved serious, it was decided to be on the safe side and repair the stack.

Peter Drolshagen, Chicago, the contractor, put on thirty-two 4 x 12-in. wrought-iron bands, 6 ft. apart, the height banded extending 190 ft. up from the breeching. By means of a cable rigging carried from band to band he was able to reach the top, where he found the stack in poor condition. As a result he had to take down 12 ft. of the stack and rebuild it, putting on a hood. The company shut down its plant and drew its fires on Thursday night and on Monday morning the contractor turned the stack over in time for work. As Friday was a holiday the company did not suffer any appreciable time loss. The work was carried on in a thick fog.

Another chimney banding job, in which Mr. Drolshagen had to start his banding from the top, was recently completed for the Baltimore & Ohio Railroad at Chicago. In this case to get his tackle and rigging to the top he shot a line up through the chimney from the bottom. The line, coiled around the mortar from which it was shot, had a weight on the end. This was shot several hundred feet in the air, and fell over the top of the stack. Stouter cable was pulled up and over, and a man sent up, who fastened the tackle at the top. Then working from the top down, the bands were placed on the tall patient. In order to get the tackle and ropes down when the work was finished, a large hook was hung on the lip of the chimney. On this hook a smaller hook was hung, with a pole about 3 ft. long attached. By juggling the rope the pole caught in the large hook, pulling the smaller hook out and dropping ropes and tackle to the ground.



TWO STACKS REPAIRED UNDER SERVICE

The top 12 ft. of the stack on the left was rebuilt in three days.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Miami Conservancy District of Ohio Is Organized

On June 28 the Miami Conservancy Court authorized the organization of the Miami Conservancy District of Ohio by a vote of five to four. The court had previously convened at Dayton on June 24 to consider the petition for organization, and on motion of the petitioners to amend their original petition to exclude Logan County and part of Shelby County the court of ten judges voted in favor of the amendment, and the judge from Logan County was excluded. The court unanimously appointed Edward A. Deeds of Dayton, director for the seven-year term, Henry M. Allen of Troy, director for the five-year term and Gordon S. Rentschler of Hamilton, director for the three-year term.

Creation of New York State Engineering Department Urged

Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, and E. P. Goodrich, consulting engineer to the president of the borough of Manhattan, appeared in Albany, N. Y., June 25 to urge before the Committee on Canals of the Constitutional Convention and the Governor and other State officers, the adoption of a proposal for creating a State department of engineering. They represented a committee of engineers made up of delegates from the New York City Engineers' Club, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Consulting Engineers and the Municipal Engineers of the City of New York.

The plan is to create a department headed by three commissioners appointed for twelve-year terms, which will gather under one control the offices of State engineer, highway commissioner, Canal Board, Department of Public Works, and other minor State engineering offices. The measure looks toward eliminating politics from the engineering work of the State, and relating all the engineering services required by the State in an efficient group under the control of a central body, which will be in office long enough to plan and carry out effective construction.

The movement has the unanimous and hearty support of all of the engineering bodies throughout the State.

Bills for Lake Erie and Ohio River Canal Become Law

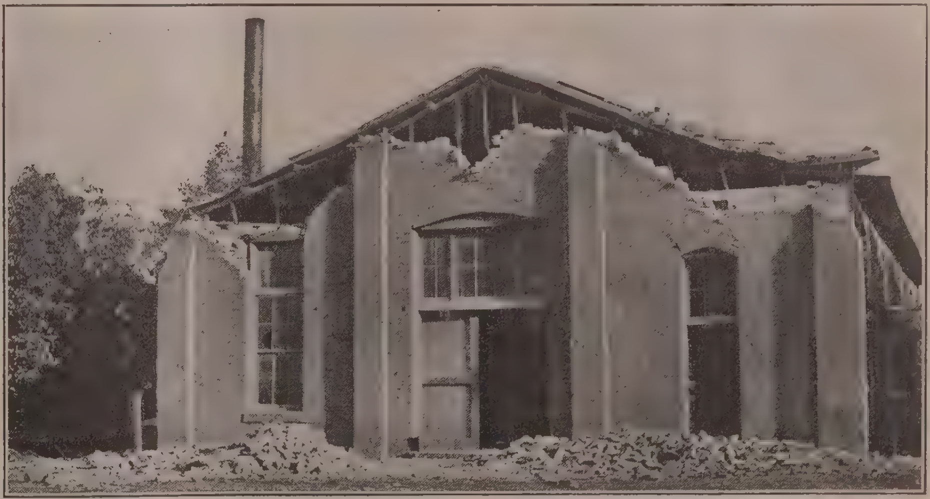
The Lake Erie and Ohio River canal bills passed by the last Pennsylvania Legislature have been signed by Governor Brumbaugh. The bills provide for the continuance of the canal commission of five members, with a somewhat different distribution of authority, and permit the counties interested to vote on bond issues to help pay for the canal.

Irrigation System Unharmed by Imperial Valley Quake

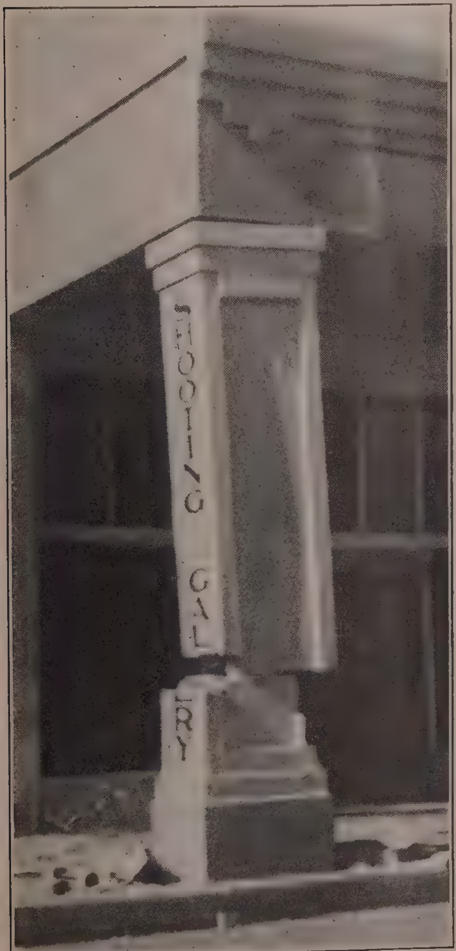
Brick Buildings Suffer Most—Waterworks Systems Were Not Injured and the Few Fires Started Were Easily Controlled

A dozen or more tremors which occurred in the Imperial Valley region of Southern California June 22 and 23 caused some loss of life and a heavy property damage, but left the extensive irrigation system unharmed. Six persons killed, all of whom were on the Mexican side of the boundary line, and perhaps two score injured, is the extent of the casualties reported, while the property loss is variously estimated at from $500,000 to $1,250,000.

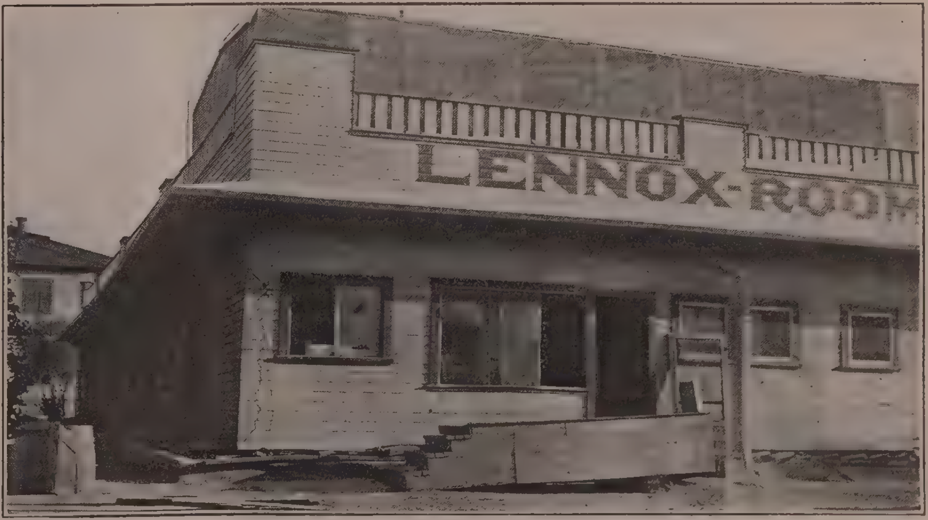
The first of the series of shocks that rocked the valley came at 8.05 p. m. June 23, others followed at 8.55, 9.30 and 10 p. m. and during the remainder of the night there were occasional shocks of lessening violence. The buildings in the various towns of the Imperial Valley are chiefly of light construction, and these suffered heavy damage. That there was not a far greater loss of life is due primarily to the fact that the heavy destructive shocks were preceded by a slight warning quake which caused practically the entire population to rush into the streets in time to escape the falling walls later.



DAMAGE TO RECENTLY LAID BRICKWORK WHERE MORTAR SHOWED NO BOND



BRICK COLUMN, 2 BY 3 FEET, SHEARED



FRAME HOUSE MOVED OFF ITS FOUNDATION, BUT APPARENTLY UNINJURED

About 100 buildings were wrecked or seriously damaged. El Centro suffered the greatest loss and Calexico next, while Heber, Holtville, Imperial and Brawley were less seriously damaged. Niland and Calipatria in the northern part of the valley were unharmed. A few serious fires started, but these were checked before they became general conflagrations that could endanger the wrecked towns. That more extensive fire loss did not occur is due, undoubtedly, to the quick action of the operator in the Holton Power Company's plant in El Centro, who cut off the power immediately when the first shock was felt.

Nature of Quake

The force of the earthquake was exerted in an east and west direction, and in both El Centro and Calexico the walls that faced east or west were damaged most; in fact, very few of them were left intact in either of these two towns. Many buildings moved east or west on their foundations. No "fault line" has been discovered, and the earthquake is thought to be in some way related to volcanic disturbances south of the boundary line in Mexico. It is reported that evidences of such disturbance have been frequent of late in the vicinity of Volcano Lake in spurting jets of steam and hot water.

Practically all structures in the Imperial Valley were deserted after the earthquake; business has been suspended altogether, and families are camping on their lawns until the buildings can be repaired or declared safe. A temporary outdoor telephone exchange has been established and telegraphic connections have been maintained continuously since the first quake. On the morning after the earthquake a meeting of the city trustees of El Centro was called by the chairman of the board, and a resolution was passed instructing Frank Harris, city architect, to start an immediate inspection of the buildings of the city. Those damaged are to be rebuilt or condemned at once. Practically all the commercial enterprises will be promptly rehabilitated, it is reported.

That the delivery of water in the canal system was not even interrupted is the cause of general rejoicing in the Valley where the crops of the season are dependent entirely upon a regular water supply. Neither the levees nor the canal were seriously injured. There was a small landslide in the Alamo waste channel which can be repaired for about $2,000, but beyond this there is no indication that the structures of the system have been subject to the racking strains of an earthquake. At Sharp's heading the ground cracked and settled badly, but the concrete structure which is the key to the major part of the system stood firm, as did the high New River flume upon which all the West Side water users are dependent.

Damage to Buildings

Brick work appears to have suffered most, though many of the buildings of this class demolished were evidently constructed with a poor grade of mortar. Many of the bricks came out clean, with no mortar adhering to them, and breaks usually followed the joints. It is well known that lime mortar does not develop full strength for many years, and all of these buildings had been constructed in the last eight years. Several reinforced-concrete buildings escaped undamaged, including the new plant of the Holton Power Company at El Centro. The old brick plant of this company was damaged where the walls were not supported by tie rods, although its roof trusses remain standing, and one of its generator units is still in operation. The Hotel Barbara Worth at El Centro was a reinforced-concrete frame building with brick walls and partitions. The brick work cracked, suffering most on the interior of the building, but the reinforced-concrete frame appears to be uninjured. The El Centro water system, including a brick and tile pumping station and a 75-ft. steel tower tank, was not injured.

American Society for Testing Materials Holds Annual Meeting in Atlantic City

Considers Measures Governing the Adoption of Standards and Ways of Increasing the Financial Strength of the Society

Chief among the happenings of general interest, at the meeting of the American Society for Testing Materials in Atlantic City last week, were the approval by those in attendance of measures to insure a still more thorough consideration of proposed specifications before final approval and the strengthening of the financial position of the society by increasing the dues. The general impressions gained from the meeting are recorded editorially on page 1 of this issue. Only such reports and papers are referred to below as are of interest to civil engineers and contractors.

Government and Finances

The meeting approved and passed on to letter ballot an amendment which would provide that all proposed new standards or proposed amendments of existing standards should on two-thirds vote of those voting be printed in the year book as "tentative standards," on which written discussions addressed to the appropriate committee should be invited. At the next annual meeting these proposed new standards or proposed amendments would be subject to amendment by a two-thirds vote of those voting and to reference by a like vote to letter ballot of the society. A two-thirds vote of those voting would then be required for adoption. This requirement, it is provided however, may be set aside by nine-tenths vote of those voting at the annual meeting and the proposals be sent at once to letter ballot. The same procedure would apply to proposals regarding "recommended practice" as to standards.

The report of the executive committee discussed at length the present financial status of the society and put forth various suggestions as to methods of increasing the revenues and decreasing the expenditures. By a unanimous vote, the first session voiced the sentiment that there should be no curtailment in the present policies of the society, but that a solution of the financial situation be found in raising further revenue. Following the meeting at which this resolution was passed, the executive committee considered the various plans and brought in a recommendation that the dues of members be raised from $10 to $15 a year and those of junior members from $5 to $7.50 per year. This recommendation was unanimously approved and passed on to letter ballot of the society. All other recommendations as to increasing revenues and curtailing expenses, as discussed in the report of the executive committee, were discarded.

The present membership of the society was announced as 1842.

The committee on papers and publications announced that for this meeting all of the papers and committee reports were preprinted, the total amounting to 968 pages. As has been done for the last two years, complete sets of pre-prints were handed to each member upon registration, so that every one in attendance was provided with all of the material coming before the meeting for discussion. As in the past this plan was highly commended by those in attendance.

The officers elected for the ensuing year were announced in the last issue of this journal, while the annual address of the president on "Rail Specifications" will be found on page 8 of this issue. A paper by Ernst Jonson on "Fatigue of Copper Alloys," which aroused considerable discussion, is also printed in this issue, page 22.

Steel

The committee on standard specifications for steel brought in an extensive report recommending some proposed standard specifications, certain revisions in present standards and a number of proposed tentative specifications. Most of these, however, appeal to specialists in other lines and not to civil engineers and contractors. Of the proposed standards passed to letter ballot and of interest to civil engineers were those for quenched high-carbon-steel splice bars, quenched carbon-steel track bolts and quenched alloy-steel track bolts. New matters to be taken up during the coming year by the committee through appropriate sub-committees are specifications for screw spikes, tieplates and ties and standard holders for 2-in. tension test specimens. An appendix to the report of the committee gave an outline of the studies and conclusions of a subcommittee which has been studying the finishing temperatures of rails. This committee summarized its conclusions as follows:

"In all of the information as to actual tests which we are able to obtain there is lacking anything which points to such decided differences in the quality of rails rolled at varying temperatures, as theoretical considerations have led some of us to expect. The differences are so slight that it seems hardly justifiable to go to any great expense in determining finishing temperatures any more accurately than is possible with the shrinkage clause, which on account of its easy application is by far the most convenient means of checking the finishing temperature."

The report of the committee on standard methods and a paper on "Elastic Limits," by T. D. Lynch, brought out a spirited discussion on the proper form of contact for extensometers. While at the beginning of the discussion a two-point instrument seemed to be favored, the three-point contact seemed to have the indorsement of most of those present. The chief conclusions drawn in Mr. Lynch's paper were that commercial accuracy can be had with a two-point contact instrument reading to 0.0001 in. per inch of gage length with a testing machine running continuously up to the yield point; that it is practicable to use an extensometer in commercial testing as well as in research, and that the society should establish practical methods of making extensometer tests in commercial laboratories, so that common conclusions can be reached by those making tests. As a result of the discussion it was voted that the recommendations of the committee on standard methods of testing with reference to determination of elastic limit, proportional limit and yield point be printed for another year in the year book.

At the session devoted to testing apparatus, papers on the failure of materials under repeated stress, by H. F. Moore and F. B. Seeley, and on "A Laboratory Method of Determining Pressures on Walls and Bins," by J. Hammond Smith, were very well received. The apparatus designed by Mr. Smith was especially commended, and the view expressed that it might result in adding considerably to our information on pressures on retaining and bin walls.

Cement and Concrete

The committee on standard specifications for cement reported that it had received the report of the joint conference, composed of representatives of the American Society for Testing Materials, the American Society of Civil Engineers and the United States Government, and that it had voted that the report be referred to subcommittees of its own committee for study and report. It further announced that the committee had voted to request the executive committee of the American Society for Testing Materials to ask the governing bodies of the other interests represented in the joint conference to refrain from publishing the data in the conference report until they could be more thoroughly studied. The committee also reported that its subcommittee on the autoclave test had concluded that this test should not for the present be adopted, because the investigations do not as yet show that the method is superior to the present test for soundness. It was also reported that a subcommittee had reached the conclusion that the Chapman method for determining consistency was not as yet reliable, and that further investigations should be made.

The report of the committee on standard tests of concrete and concrete aggregates reported its program for the coming year, which is reprinted on page 14 of this issue.

A paper on the "Micro-Structure of Concrete," by Nathan C. Johnson, was received with much interest and carefully discussed. Henry S. Spackman and P. H. Bates disagreed with Mr. Johnson that there were relatively large groups of unhydrated particles of cement to be found in concrete. They believed that the groups so termed by Mr. Johnson were really particles of clinker. Furthermore, they did not believe that the cracks running through concrete, which Mr. Johnson explained as being due to the expansive forces of salt crystallizing in initial pores, were really formed in that manner. They were of the opinion that these cracks were due to shrinkage.

Ceramics and Lime

Standard specifications for paving brick, proposed by the brick committee, were approved by the meeting and sent to letter ballot. Similar action was taken on standard specifications for quicklime and hydrated lime, which had been offered as tentative specifications last year and had been printed for one year in the year book.

Much discussion followed the paper by Edward Orton, Jr., on "The Legal Interpretation of the Word Vitrified as Applied to Ceramic Products." It was felt that the subject was of much importance, and since it concerns all committees dealing with ceramic material, it was voted to refer the paper to the committee on brick with instructions that the committee confer with committees studying other clay products.

The report of the committee on standard specifications and tests for clay and cement sewer pipe brought in proposed tentative "recommended practice" for the laying of sewer pipe. This specification was brought in with the clear understanding that engineering practice of this sort is outside of the province of the American Society for Testing Materials, in the belief that this was a very special case. It was decided to send the proposal to letter ballot to be adopted as purely tentative, with the understanding that the entire subject of the extent to which the society should go into matters of practice should be taken up by the executive committee, the committee on drain tile and the committee on sewer pipe for a broad discussion of the entire question. It is the expectation of the executive committee that a full report on this most important subject will be brought in at the next annual meeting. Sentiment in the session was strongly in favor of continuing the present limitation of the society's activities—to specifications for materials only, leaving engineering practice to other organizations.

Proposed standard definitions of terms relating to sewer pipe, proposed by the same committee, were sent to letter ballot.

The committee on gypsum and gypsum products, recently organized, reported that it had appointed subcommittees on gypsum for various uses, on gypsum plasters, on structural gypsum products, on testing methods and on nomenclature.

Timber and Road Materials

The committee on standard specifications for timber brought in a proposed revision in the standard classification of structural timber, abandoning the longleaf and shortleaf classification and substituting therefor the grades of dense Southern yellow pine and sound Southern yellow pine. The former calls for six rings to the inch, showing at least one-third summer wood, or else one-half summer wood for wide-ringed material. Proposed revisions were also brought in for the standard specifications for yellow pine bridge and trestle timber, and while objection was made to the wording of both of these revisions they were ultimately passed to letter ballot. Proposed tentative specifications for Southern yellow-pine piles and poles to be creosoted, for other Southern yellow-pine timber to be creosoted, and for the sampling and analysis of creosote oil, were brought in and ordered printed in the year book for one year.

Certain proposed revised definitions brought in by the committee on standard tests for road materials were passed to letter ballot, while some nine definitions on non-bituminous materials were referred to a conference committee representing both the road committee and the committee on concrete and concrete aggregates. Certain other definitions were referred back to the committee on road materials for reconsideration. Proposed standard definitions reported by the joint committee representing committees D-4, C-9 and D-8 were passed to letter ballot. A proposed tentative method for the determination of the penetration of bituminous materials, offered by this committee, was ordered printed in the year book.

Dr. Newell Urges Co-operative Engineering Publicity

A recent proposal of Dr. F. H. Newell, former director of the U. S. Reclamation Service, looking to the creation of a central agency for co-operative publicity regarding engineering achievement, was the subject of discussion at an informal meeting of engineers at Buffalo, June 24. The meeting was called by Dr. Newell during the week of the spring meeting of the American Society of Mechanical Engineers.

His suggestion has for its prime object the advancement of the material welfare of engineers. To accomplish this end he has proposed systematically and intelligently to educate the public, through the press and otherwise, to a proper appreciation and understanding of the work done by engineers, and the service which the engineer is prepared to render in civic affairs. The widespread desire for a better understanding of the engineer by the public was reflected at the meeting, and the time was thought to be opportune for beginning a movement with this purpose in view.

From the many written opinions received by Dr. Newell, and also from the discussion at the meeting, it was evident that there is a general feeling that the machinery for doing this work already exists in the several engineering societies, once it is thoroughly organized and directed toward the common end. Several of these societies, particularly the local societies, are now co-operating with the local press in producing articles of popular interest concerning engineering work. In many cases these articles prove to be of more than local interest, and could be more widely utilized through a central organization. The publicity work being done by the engineering societies of several of the large cities was discussed at some length. The opinion seemed to prevail that much useless repetition and waste of effort is already going on among the various organizations, through the lack of means for diffusing the experience of each society among the others.

Several other benefits which might accrue from the proposed co-operation were also discussed. The advantages of what might be termed a National employment service, affording a local society an opportunity to keep in touch with the supply and demand elsewhere, were brought out. In this way one society, finding difficulty in placing all of its unemployed locally, might take advantage of outside demands. The possibilities of securing better legislation through co-operation between the different societies was also pointed out.

A later conference was suggested at the meeting, to which representatives from many of the societies interested will be invited with a view of perfecting an organization for launching the work proposed by Dr. Newell.

Railroad Takes Lead in Planning Flood Prevention

The Union Pacific Railroad has made at its own expense a survey of the Kaw River watershed in Kansas, Nebraska and Colorado, which is considered by the officials of the road detailed enough to warrant the assertion that the disastrous floods frequently experienced in this district could be controlled by twenty-six earth dams. The reservoirs behind these dams would occupy a little more than 100,000 acres, and would be located on the tributary streams of the Kaw. This, it is said, would be much less expensive than to locate reservoir sites in main valleys, which are all under cultivation, and in which are railway lines that would have to be relocated. The estimated cost of $11,500,000 is only about five times the sum already spent to safeguard Kansas City, Kan., from the Kaw River. The interest and maintenance on this reservoir system is estimated at a little less than $600,000 yearly. This sum, the railway officials believe, would be much more than earned in eliminating the serious yearly damage to crops on the watershed. As was pointed out by engineers who made an investigation of this scheme for the U. S. War Department some years ago, these dams could not be counted on to develop power which might be sold to pay the interest on their construction. To be effective, the reservoirs would, of course, have to be empty at the beginning of the season when heavy rains may be expected.

Besides damaging crops, floods on this watershed have caused large direct losses to the railroads by washing out tracks. No figures have been given out, but it is well known that every recent flood on this watershed has seriously interrupted traffic on the Kansas division of the Union Pacific system.

A. M. Mohler, president of the Union Pacific Railroad, hopes to interest the public officials of the three States mentioned in this plan, which would require State aid for its realization.

Engineers Condemn Power Development Scheme in Missouri

The Associated Engineering Societies of St. Louis recently adopted a committee report which characterized as impracticable a power canal now being urged before the Missouri Legislature. The proposed plan is to develop hydroelectric power to supply the city of St. Louis by constructing a canal from the Missouri River to the Meramec River. The sponsors of the scheme would use a supposed fall from the Missouri to the Meramec to develop 200,000 hp. The committee report referred to states that at certain stages of water, which occur frequently during the year, the flow in such a canal would actually be reversed, and that there is no continuous difference in the elevation of the two rivers which could possibly be used to develop electric power commercially.

Los Angeles Engineering Societies Unite in New Organization

The Los Angeles Chapters of Seven Technical Societies held a banquet in that city on June 15, at which a new organization, to be known as the United Technical Societies of Los Angeles, was founded. Brief addresses were made by William Mulholland, Samuel Storrow and James A. B. Scherer, president of Throop College of Technology, the subject of the evening being "The Service of the Technical Man to the Community." It was announced that Gen. George W. Goethals, Governor of the Panama Canal Zone, would be invited as guest of honor and principal speaker at the next meeting to be held early in September. The societies represented in the new organization are the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Chemical Society, The Engineers' and Architects' Society, and the Institute of Architects.

Structural Society Condemns Shopping for Steelwork

The dulness in domestic structural-steel construction which has continued for some time seems to have brought out a practice which, it is claimed, has been very bad for the steel contractors and fabricators. After advertising for bids on the steelwork, and using the lowest received to secure a general contract, it is said that some firms have taken advantage of the present condition of the market to obtain lower prices by disregarding the original low bidder and peddling the steelwork around still further. To correct this condition the Bridge Builders and Structural Society has adopted a resolution condemning the practice and terminating as follows:

"Be it further resolved: That on and after July 1, 1915, the members of the Bridge Builders and Structural Society will endeavor to induce, as a matter of fairness and justice, all owners and architects to receive prior to or simultaneously with bids of general contractors a separate and distinct bid on the structural-steel requirements where the aggregate is in excess of 250 tons, such bid to be publicly opened, with the understanding that the most favorable bid will be accepted, or recommended for acceptance if the general contract is let."

State to Construct Ocean-to-Yuma Highway Route

The State of California has decided to construct the last link in the Ocean-to-Yuma highway lying between the San Bernardino County line and Yuma. This decision was made on the advice of the Highway Advisory Board at Sacramento after two bills, each carrying an appropriation for $100,000, had been passed by the State Legislature for building two roads over this territory. There had been great rivalry in the matter of choosing the road through Imperial County, which resulted in the passage of the two bills.

Governor Johnson refused to sign both of these and called a conference of the Advisory Board with the result that funds will be supplied from the motor and vehicle tax and convict labor from the State penitentiary will be used on the construction. This will enable the road to be built without the delay necessary if funds from the new $15,000,000 bond issue were to be used.

Riverside and San Bernardino Counties are to contribute $500,000 jointly toward the new road, and Imperial County is to build all the bridges and culverts at an estimated cost of $50,000.

Alaskan Timber Reserve No. 1, 200 Miles Long, Established

In order to prevent the timber needed for the construction of the Government railroad and its branches in Alaska from falling into private hands and necessitating repurchase by the Government, President Wilson has signed an order establishing an extensive timber reserve, approximately 200 miles long and from 5 to 10 miles wide. The reserve follows the route of the railroad along Knik Arm and Cook Inlet and up the Susitna valley to Broad Pass, and also includes the proposed branch line to the Matanuska coal fields. Only the timber, not the land itself, is reserved, states a bulletin from the U. S. Department of the Interior, and it is not the intention of the Government to make any unnecessary restrictions which will tend to retard development along the line of the railroad. When it shall be determined that no more timber is needed within a locality, the lands within that locality will be eliminated from the reserve.

Engineers Must Get Together

In the course of a recent talk before the San Francisco Association of Members of the American Society of Civil Engineers, Charles Warren Hunt made an appeal for more united action in other than technical matters on the part of the engineering fraternity. The following is quoted verbatim from his address:

"The time has come when engineers must realize the necessity for united action in all matters which affect the profession. There is no need of additional professional societies. What we need is united effort and the cultivation of a spirit of compromise which will subordinate narrow, individual views and foster and expand human and social elements in the profession. Why should not engineers of all kinds and types get together, and in so doing advertise in a perfectly proper and legitimate way, by educating the public to a better realization of what the profession accomplishes and what its services are worth?

"In the five national societies of civil, mining, mechanical, electrical and naval engineers there are approximately 30,000 trained minds, most of them pulling in different directions. Why should these able and keen-minded men allow other professions to outstrip theirs in matters which are not purely technical? Why should we not realize that in addition to being technically proficient we must be men of affairs, club men, civic men, broad men, whose influence in the body politic shall be recognized by all our fellow citizens?

"There are already signs of an awakening in this direction. We are working together for the coming International Engineering Congress; for eight or ten years the National Societies have been united in the annual award of the John Fritz medal; the Engineering Foundation for research work has been started by a fund of $200,000 donated by an engineer, and which is to be administered by representatives of all branches of engineering. These and other plans, which are likely to develop in the near future, indicate a general realization of the necessity for concerted action, and emphasize the fact that this necessity is apparent to those who have given thought to present conditions."

Building Data League Organized

The Building Data League, Inc., has been organized as a corporate association of consumers, for the purpose of securing through co-operation exact and reliable information as to the quality and economic value of the vast number of materials, methods and devices offered for use in the construction and equipment of buildings.

The league's purpose is to establish market standards in the building industry, in order that demand may find definite expression. Through the work of the league the consumer may readily secure accurate information and a working knowledge of available materials, methods and devices. Reciprocally, the league will focus upon the producer the demand of the consuming class for the attainment and maintenance of high standards and honorable methods in the manufacture and marketing of his product.

The league will accept such standards of quality as are established by recognized authorities, but where such standards are lacking, the league will establish them for its use through co-operative research, investigations and examinations. The products will be given a market rating with regard to their value measured by such standards.

Since a considerable amount of time will be necessary in order to make the needed investigation, an agreement has been made by the league with the Building Data Company, Inc., to do the necessary work. This company has been especially formed for the purpose of rendering technical service to the league.

As an indication of the diversity of subjects covered, committees have been formed on non-ferreous metal products, fireproofing and fire protection, electrical devices and equipment, sanitary equipment, building stones and structural methods. There are in all seventeen technical committees.

The incorporators and first directors are engineers and architects from, principally, New York City and vicinity, though Boston and Chicago are included in the first list of directors. Among the incorporators are, Gustav Lindenthal, consulting engineer, New York, and Prof. James C. Macgregor of Columbia University. Among the directors for the first year are: Frederick A. Burdett, Job R. Furman, Prof. Charles. W. Killam and Mr. Lindenthal, all members of the American Society of Civil Engineers. Among the directors of the Building Data Company, Inc., is William A. Aiken.

Offices of the league are at 105 West Fortieth Street, New York City.

After Four Years Chicago Smoke Committee to Talk

The committee of the Chicago Association of Commerce on smoke abatement and electrification, nearing the completion of its comprehensive investigation of Chicago's smoke problem, plans to make in the near future a series of preliminary reports comprising various phases of its extensive inquiries.

The work of this committee has continued nearly four years under the direction of a chief engineer and a technical staff of between fifty and one hundred engineers, inspectors and other assistants. The data which the committee has selected for its report fill several thousand pages.

All American Countries Invited to Road Conference

Under the auspices of the American Highway Association, the American Road Builders' Association and the Tri-State Good Roads Association, a Pan-American Road Conference will be held in Oakland, Cal., Sept. 13-17, 1915. A program is being prepared which it is believed will thoroughly cover the subject of road building and street improvement. The papers presented will be prepared by men who are prominent in their respective fields.

Invitations to attend and to appoint delegates have been sent to the Governors of each State, the Lieutenant Governors of the Canadian Provinces, and to the Presidents of the South American Republics.

News of Engineering Societies

The Cleveland Engineering Society went to Buffalo June 24 in a body on a special steamer to attend the meeting of the American Society of Mechanical Engineers.

The Albany Society of Civil Engineers held a meeting at Keeler's Maiden Lane Hotel, June 22, at which Harold E. Hilts, representative of the American Portland Cement Manufacturers of Philadelphia, spoke on "Concrete Roads."

The American Institute of Consulting Engineers found it necessary to postpone the meeting schedule for June 29 at the Engineers' Club, New York City. At the next meeting, which will be held in the fall, important business will come up for decision.

The Society for the Promotion of Engineering Education held its annual convention at the Iowa State College, Ames, Iowa, June 22. Anson Marston, dean of the engineering division of Iowa State College, and president of the society, presided over the session.

The Pacific Northwest Society of Engineers held its thirteenth annual convention in Seattle, June 17-18. Oscar S. Bowen, principal assistant engineer of the Great Northern Railway, delivered an illustrated lecture on the snow-sheds near Scenic, Wash. Marvin Chase, president of the society, delivered the annual address. Jesse A. Jackson is secretary and M. H. Strouse assistant secretary of the society.

The National Paving Brick Manufcturers' Association will hold its annual meeting in Dayton, Ohio, Oct. 11 and 12. This arrangement will enable its members to attend the meeting of the American Society of Municipal Improvements which will also hold its annual meeting in that city Oct. 12-14, and will give engineers of Ohio, Indiana, Kentucky and other States, who have not hitherto been members of the latter society, an opportunity to become acquainted with its purposes.

The Engineers' Club of Baltimore, at its annual meeting held recently, elected Oscar F. Lackey president. The other officers elected were: W. Watters Pagon, vice-president; John M. Mackall, chairman of the house committee; R. Keith Compton, W. W. Crosby and Ezra B. Whitman, members of the board of directors. At the organization meeting of the board of directors held later, William D. Janney was re-elected secretary-treasurer. The next meeting of the club will be held the first Thursday in September.

The Western Society of Engineers, bridge and structural section, held a postponed meeting June 24, at which C. N. Bainbridge, office engineer of the Chicago, Milwaukee & St. Paul Railway, presented a paper on grade-crossing elimination in cities. Data from this paper were presented in the Engineering Record of June 19, page 770, and it was there stated that the paper was presented as scheduled June 14. After the abstract referred to had gone to press it was learned that on account of the Chicago street-car strike the meeting was postponed.

Personal Notes

A. K. Nicolaysen, appointed assistant city engineer of San Antonio, Tex., to design special bridge work for the city, has resigned with the completion of this work.

Paul Nash has been reappointed city engineer of Stamford, Conn., for a term of four years. Mr. Nash has been city engineer of Stamford for the last fourteen years.

William N. Jones, special engineer in charge of the construction of the new filters for the city of Minneapolis, left the city's service on July 1, following the completion of the plant.

Benjamin E. Winslow, consulting architectural engineer, of Chicago, has been appointed architectural engineer for the Chicago Building Department to succeed J. Norman Jensen.

Frank E. Davidson, architect and engineer, of Chicago, has been elected president of the Illinois Society of Architects. Mr. Davidson is also a trustee of the Western Society of Engineers.

W. G. Hare has been appointed resident engineer on the construction of a pier and pumping plant for the Scripps Institution for Biological Research of the University of California, at La Jolla, Cal.

R. McA. Beemfield, recently superintendent of construction on the $500,000 State armory just completed at San Francisco, has taken charge of the construction of the State Normal School being erected at Los Angeles.

George E. Goodwin, assistant engineer, with the United States Government, has gone to Fort Klamath, Ore., to take charge of the construction of roads and bridges to be built this summer in the Crater Lake National Park.

F. C. Dreyfus has been appointed county engineer for Lake County, Florida. Mr. Dreyfus has recently been in charge of special highway work at Tyler, Tex., and was formerly county engineer of Covington County, Alabama.

Louis Mitchell, assistant professor of civil engineering at Syracuse University, who has been on a year's leave of absence to take graduate work at the Massachusetts Institute of Technology, completed his work there and was awarded the degree of Master of Science, June 8.

H. E. Bilger has been given the degree of master of science by Bucknell University. Mr. Bilger is road engineer of the Illinois State Highway Department. He was formerly senior highway engineer with the United States Government, and has had a large experience in road building and railway work.

B. G. Slining has severed his connection with the Southwestern Engineering Company of San Antonio, Tex., of which he has been vice-president for the last three and a half years. After a trip to Chicago, Mr. Slining will return to San Antonio to take up the investigation of several hydraulic developments.

Frank R. Farnham has joined the staff of Walter B. Snow, publicity engineer and advertising agent, Boston. Mr. Farnham was previously with the McGraw Publishing Company, in charge of copy service department for Engineering Record, *Electrical World*, *Electric Railway Journal*, and *Metallurgical and Chemical Engineering*.

William A. Smith, formerly in charge of grade-crossing elimination work on the New York Central & Hudson River Railroad in the vicinity of New York City, has been appointed village engineer of Tuckahoe and town engineer of Eastchester, N. Y. He will also maintain an office for the purpose of practising as consulting engineer at Tuckahoe.

Maj. Wildurr Willing, Corps of Engineers, U. S. A., has been detailed to superintend the construction and repair of aids to navigation in the Fifteenth Lighthouse District, relieving of this duty Col. Curtis McD. Townsend, Corps of Engineers, U. S. A., division engineer of the Western Division. Major Willing was formerly under the immediate orders of the St. Louis district engineer office.

Sutton Van Pelt has engaged in consulting work, including engineering construction, with an office at La Porte, Ind. Mr. Van Pelt has been connected with the U. S. War Department in the design and construction of locks, dams and canals in Alabama and Michigan. He has also been engineer and manager on many important construction projects in the Central States.

Lieut.-Col. Jay J. Morrow, Corps of Engineers, U. S. A., will go to Panama early in August to assist Lieut.-Col. Chester Harding, who, it is understood, is to take the place next November of Gen. George W. Goethals as Governor of the Canal Zone. Colonel Morrow will then succeed Colonel Harding as engineer of maintenance of the canal. Colonel Morrow is now in charge of the First Portland (Ore.) District of the Northern Pacific Division. Under this district are the Government improvements to the Columbia, Willamette, Coquille and Coos Rivers, including the Dalles-Celilo Canal.

Thomas L. Fountain, of the Fountain-Shaw Engineering Company of Dallas, Tex., has been appointed engineer of sewers for the city of Dallas. He was graduated from Cornell University in 1905. As assistant engineer for Alexander Potter, consulting engineer, of New York City, he was in charge of the drafting room and the design of sewer works. He supervised the construction of additions to the West Orange (N. J.) water system. In 1907 he made surveys and plans for a water development and a 1000 hp. hydroelectric plant for the Giraux Consolidated Mines Company of New York City. In 1908 he was appointed assistant resident engineer on the construction of the McKeesport (Pa.) water-purification plant. He became a member of the Fountain-Shaw Company in January, 1909.

R. H. Howard, formerly general manager of the New Orleans Great Northern Railroad, has been appointed chief engineer maintenance-of-way of the Wabash Railroad, with headquarters at St. Louis. Mr. Howard, who was born at Zanesville, Ohio, entered railroad service in 1889 as draftsman for the Cincinnati & Muskingum Valley Railroad. He was subsequently assistant on engineer corps, and chief clerk to the engineer maintenance-of-way. In 1902 he went to the Vandalia Railroad as assistant engineer, and three years later was made principal assistant engineer of the Chicago & Eastern Illinois Railroad. Within a few months he became engineer maintenance-of-way, remaining at this post until 1910. Then for a few months he was on special railroad work for private interests, and early in 1911 he went to Jackson, Miss., as chief engineer of the Great Southern Lumber Company and engineer maintenance-of-way of the New Orleans Great Northern Railroad. He was advanced to general manager of the railroad in June of the same year.

Obituary Notes

Arthur Marshall Morgan, a Chicago hydraulic electrical and sanitary consulting engineer, died in that city June 28. Mr. Morgan for more than twenty years was a member of the Chicago firm of G. C. Morgan, consulting hydraulic engineers. He was a member of the Western Society of Engineers.

William McKenzie Hughes, a consulting structural engineer of Chicago, died in that city June 25. Mr. Hughes was born in Utica, N. Y. in 1848 and graduated from Cornell University. He came to Chicago as engineer of construction at the world's fair. He was city bridge engineer in 1893 and 1894. He had also held a similar position in Cleveland and Cincinnati. He was engineer during the construction of a number of the Chicago elevated roads. For several years prior to 1899 he was bridge engineer for the Sanitary District. Since that date he has been in consulting practice for himself. He has been for many years a member of the American Society of Civil Engineers and Western Society of Engineers.

Civil Service Examinations

United States.—The Civil Service Commission announces that examinations will be held this fall at the usual cities throughout the country for the positions enumerated below.

September 15.
- AID, COAST AND GEODETIC SURVEY.
- COMPUTER COAST AND GEODETIC SURVEY.
- DRAFTSMAN:
  - Copyist topographic, departmental service.
  - Junior engineer, Engineer Department.
  - Topographic, departmental service.

October 13.
- AID, BUREAU OF STANDARDS.
- CIVIL ENGINEER AND DRAFTSMAN.
- DRAFTSMAN:
  - Topographic, Panama Canal Service.
  - Ship, Navy Department.
- ENGINEER, INDIAN SERVICE.

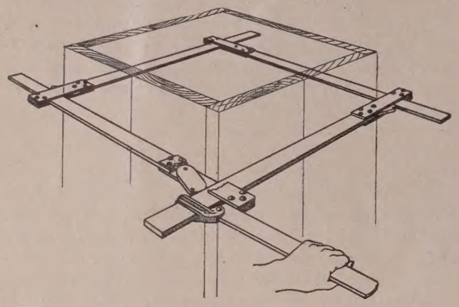
Application forms and full information may be obtained by addressing the U. S. Civil Service Commission, Washington, D. C., or the secretary of the Board of Examiners at the following named places: Post office, Boston, Mass.; Philadelphia, Pa.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Cal.; Customhouse, New York, N. Y.; New Orleans, La.; Old Customhouse, St. Louis, Mo.

New York State.—An examination for assistant engineer, water-power, storage and drainage, Conservation Commission, salary $3,000 a year, will be held July 31 at various cities throughout the State. Applicants must be 21 years of age, citizens of the United States and trained civil engineers with experience in all three lines mentioned in the title of the position. Application blanks must be received in the office of the State Civil Service Commission on or before July 21. No application blanks will be sent out by mail after July 19. For further information, apply to the State Civil Service Commission, Albany.

Concrete Form Appliances That Will Interest Contractors

Designed to take the place of wooden shores and clamps in concrete form work, cut the labor cost of erection, wrecking and rebuilding, and save on the lumber required, a series of adjustable metal form supports have just been placed on the market.

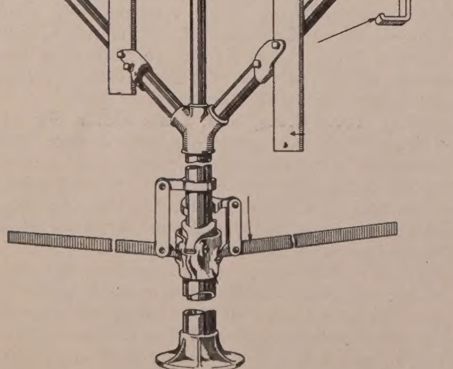
The adjustable metal shore and clamp combination illustrated herewith has a horizontal member at the top which supports the beam bottom. Two vertically and horizontally adjustable arms are supported by hooks and links which carry the weight. Adjustable collars slide on the pipes of which the support is made. They are capable of being securely fastened in any position, to hold the beam sides in place. The upper ends of these beam-side clamps are provided with a bracket to support the joists. So secured to this bracket that it may be detached is a stirrup which supports a timber running from bracket to bracket and carrying the ends of intermediate joists. In this way all joists are adjusted to the proper height from one bearing. By the vertical adjustment of these clamps, together with this joist-supporting timber, the entire floor is adjustable as a unit.



FORM CLAMP SQUARES COLUMNS SO THAT ALL CRACKS ARE CLOSED

The work of wrecking is simple. For ordinary adjustment only one lever is required, and therefore a single-lever shore for temporary work has also been devised. These shores have an adjustment of 3 ft. 6 in. The closed height is 9 ft., and the extended height 12 ft. 6 in.

A feature of the metal column clamp is that it can be adjusted very closely. When a set of them are in place, they automatically square the column, and can be tightened from all sides so as to close all cracks. The clamps will be loosened very quickly. The clamp is made of heavy steel bars with one end provided with a toothed locking-dog, pivoted between two plates, which are riveted to opposite sides of the bar. Sufficient space is allowed to enable the bar to slide freely when the locking-dog is not engaged. For octagonal column clamps, four additional bars are used. The clamps, which will accommodate any usual size of column, and the shores are manufactured by the Gemco Manufacturing Company of Milwaukee.



ADJUSTABLE PIPE BEAM SUPPORT WITH BRACKET TO HOLD THE JOISTS

Two-Speed Gear Change Said to Prolong Life of Brush Sweeper

A feature of the latest model revolving brush sweeper to be placed on the market is the addition of a two-gear change which it is claimed allows the sweeper to work at maximum capacity until the brush is entirely worn down. The broom is thrown into high or low speed by a lever at the driver's right as on an automobile. As a result the surface speed of the broom can be increased when its diameter is reduced, thus keeping up the cleaning efficiency when the broom is worn. The team is driven at the regular rate with the broom at high speed.

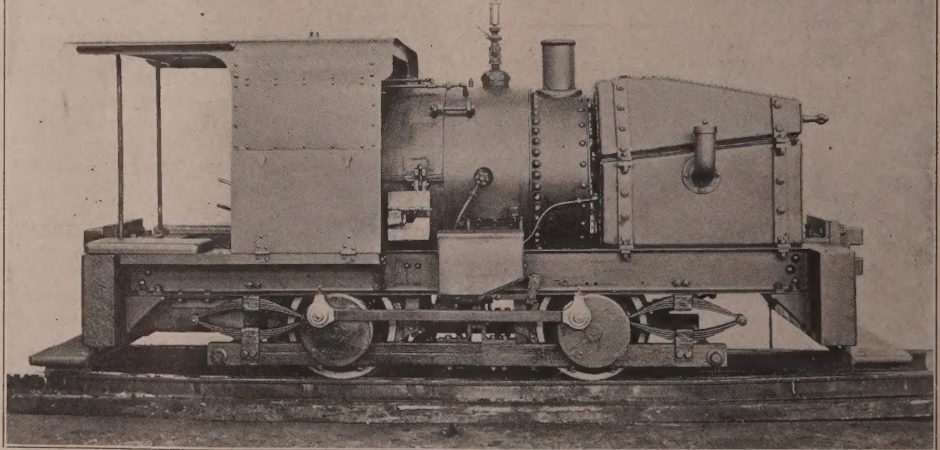
From a galvanized iron tank, holding 200 gal., mounted on top of the wagon platform, water is sprayed just ahead of the broom through either, or both, of two perforated pipes. Two valves controlling the spray are at the extreme right of the driver. If the streets are cleaned at the proper intervals, the spray on this machine will apply enough water to make the dirt mealy. The outfit is compact and of light draft, with no load on the horses' necks. The broom is reversible, revolves in ball and socket joints and is hung from an equalizer bar fitted with adjustable weights. The machine is manufactured by the Austin-Western Road Machinery Company, Chicago.

Oil-Burning Contractor's Locomotive Develops High Traction

Burning oil, or other liquid fuel, a new construction locomotive made by the H. K. Porter Company, of Pittsburgh, is run by an engine geared 2 to 1 to the driving wheels. This arrangement gives a much more even torque on the drivers than can be had with a direct drive. This results, it is claimed, in easier and quicker acceleration, and in eliminating swaying at full speed. The engine itself has roller bearings, and is built with much more care and accuracy than is the usual practice with direct-connected engines. This, it is claimed, makes a high speed possible without undue wear, giving this locomotive very nearly the same track speed as is obtained by other dinkies.

This engine is equipped with a new type of horizontal boiler having a large number of ½-in. copper flues about 16 in. long. The boiler and smoke box on the 5-ton size measure only 37 in. over all. This type of boiler is said to raise a full head of steam with oil firing in fifteen minutes. The wheels are rigidly connected to the subframe, which supports the main frame on elliptical springs. The pull is taken through these springs, assisted by a set of angle bars mounted between the two frames. Strength, flexibility and ease of repair are claimed for this arrangement.

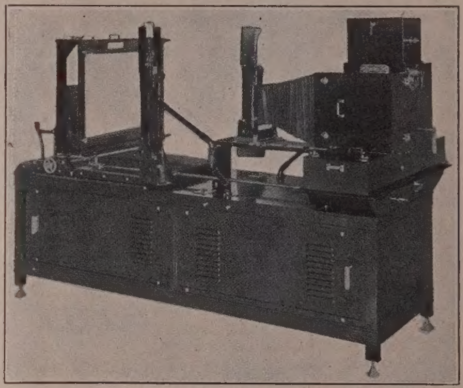
Locomotives are furnished in from two to twelve ton sizes, of any gage. With gasoline for fuel, they may be used in tunnel work. They may be operated in the open with kerosene or any fuel oil.



GEARED OIL-BURNING LOCOMOTIVE EQUIPPED WITH A NEW TYPE OF HORIZONTAL BOILER RAISES STEAM IN FIFTEEN MINUTES

Machine Reproduces, Develops and Prints all in Itself

Facsimile reproductions of blueprints, maps, drawings, specifications or, in fact, any printed or written matter that the contractor or engineer desires to reproduce, may be obtained by means of the "Cameragraph," manufactured by the Cameragraph Company, Kansas City, Mo., a photographic appliance which exposes, develops and fixes the prints entirely within the machine, without the use of a dark room, plate or film. It is compact and its mechanism is simple, requiring no expert knowledge on the part of the operator. Through one lens and at one exposure either the two facing pages of a book or the opposite sides of the same page may be photographed direct on paper sensitized on both sides. If it is desired to use only one side, paper sensitized on one side only can be obtained. Where paper coated on both sides is used, 100 per cent more print surface is secured at 50 per cent additional cost.



MACHINE MAKES DIRECT PRINTS WITHOUT USE OF DARK ROOM, PLATE OR FILM